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PROPOSED SCHEME FOR A COLLEGE OF TROPICAL AGRICULTURE IN CEYLON.

Peradeniya, August 15, 1913.

The movement in favour of a College of Tropical Agriculture in Ceylon has made considerable progress since the report of the Committee was issued in March last. The Committee were instructed to take steps to arouse public interest and it will be admitted, I think, that they have successfully given effect to the idea which led to their appointment. Perhaps the most gratifying feature of the movement is the response of those in England whom the Committee invited to join the London Committee and the success they are achieving in enlisting the support of other distinguished men.

The time would seem to have come for some expression of opinion as to what is actually contemplated by a College of Tropical Agriculture. The public who will be invited to subscribe to the foundation fund will certainly desire to know at least in general terms what it is they are being asked to promote. The hands of the London Committee would probably be strengthened if we acquainted them with the tentative plans we may have formed.

The following is put forward as purely a tentative scheme not intended to commit the Board or anyone else, but merely as an outline for future discussion. In drawing up this scheme I have had the benefit of the advice of members of the staff of the Department of Agriculture as well as that of other gentlemen in Ceylon.

SITE.

By the foresight of Dr. Willis, late Director of the Royal Botanic Gardens, Peradeniya, some 40 acres of old cocoa were reserved as a possible site for a College. This block of land is situated on the left bank of the Mahaweli Ganga (river) on the Experiment Station. The actual spot selected for the buildings is opposite the Palmyra Avenue of the Royal Botanic Gardens at a point where the left bank is high. The pile of buildings will form a picturesque and imposing addition to the attractions of the Gardens.

A view of this proposed site is given showing the Mahaweli Ganga, the largest river in Ceylon. It is taken from the Royal Botanic Gardens and shows on the opposite bank a part of the Peradeniya Experiment Station. The elevation is 1,600 feet above sea level ; and the climate is therefore not of that hot steamy character one generally associates with tropical rivers ; but on the contrary is pleasant and healthy.

CHARACTER OF BUILDINGS.

Two suggestive designs are attached ; one prepared by Mr. Hubert Walker, A. R. I. B. A. of Messrs. Walker and Adams, Architects, Colombo, the other by Mr. William Claessen, M. S. A. of Messrs. Walker, Sons & Co., Ltd., Colombo. The general arrangement as to the three main buildings is after that of the Cornell College of Agriculture in the United States : three detached buildings permitting of a good circulation of air round each one ; a very essential point in this country.

Mr. Walker estimates the cost of buildings as designed by him at Rs. 562,000 (£ 37,466); Mr. Claessen that of his buildings at Rs. 594,566 (£39,637).

It has been necessary to protect them by verandahs, a feature also imposed by our tropic climate but which the buildings of Cornell do not possess. Some of the laboratories are in low detached buildings behind, forming a quadrangle and constructed to allow of a maximum amount of light. It has been considered better to have these laboratories in separate buildings for the sake of cleanliness, convenience and light.

The central building will have a large auditorium to accommodate about 200 people.

The physics laboratory will be on the ground floor of this building. lecture theatres, library, reading room, museum being also provided for.

One of the wings will be for the accommodation of dormitory students, the other for those with private rooms and for some of the staff.

Opinions will differ as to the number of students to arrange for. Young Englishmen, not fortunate in having planting connections in the East, would no doubt come to use the College as a "jumping off place." The College will provide a base from which to study the outlook and make friends while all the time they would be undergoing the best possible training for their future planting careers. I regard this rôle which the College is likely to play as a very important one. If it were found that the accommodation was not sufficient it would be easy to extend, but I think on the whole it is better at first to underestimate than to risk buildings standing half empty.

An engine house, laundry, store houses and garage will complete the group.

Behind the group will stretch the recreation grounds and on the hillside beyond sites could be found for the bungalows of the Principal and some members of the staff.

SUBJECTS TAUGHT.

The principal subjects taught will be :—

Agriculture
Chemistry, Soil Bacteriology
Botany, Mycology
Zoology, Entomology
Horticulture
Irrigation
Veterinary Science
Physics, Land Surveying, Mechanics
Meteorology
Book-keeping

The subject of Agriculture will be complicated though presenting no practical difficulties. With temperate agriculture one man can master the whole subject but I doubt whether this would be possible with tropical agriculture as many of the subjects are of a highly specialised nature. Certainly it would be impossible in practice. One man may be an experienced rubber, tea and cocoa planter but it is hardly likely that he would in addition be an experienced coconut planter. With a highly specialised subject like sugar it is rare to find one man who is good in the field and at the same time good in the factory. Again many tropical products such as tea, rubber, cocoa, fibre, sugar, have not only to be grown but manufactured also; a dual task the temperate farmer is generally spared.

It is not proposed of course to staff the college with a specialist for each principal product nor to try and turn out students capable of taking charge of every kind of plantation ; but each lecturer on agriculture should as far as possible have had practical experience in growing the products he is to lecture upon and each student should be given instruction in the general principles governing the cultivation and, where this is also done by the planter, manufacture of every tropical product ; so that no matter what product he may meet with in the course of his career he will understand at least the general principles of its cultivation.

The Principal would be responsible for the lectures on Agriculture and would require one assistant lecturer. Some of the subjects, as for example those in which they were especially experienced, could be taken by members of the technical and administrative staff of the Department.

It will be possible to deal with the other subjects on comparatively simple lines. The principles of Agricultural Chemistry, for example, are the same for Ceylon as for Europe. Botany, Entomology and most of the other subjects can be taught as to their fundamentals in any country though it would be necessary for students to specialise in them in Ceylon. But this would not be the same thing as taking up a completely new subject like the cultivation of rubber or coconuts which cannot be learnt anywhere except in the tropics.

Under Book-keeping, systems of Plantation account books would be taken but I don't think we should profess to teach estate management in so far as it is concerned with the management of labour. The management of labour is a matter of language, of experience and of temperament. Facilities

would be provided for learning Tamil but we could not offer students at the College practical experience of any real value in the handling of labour while of course the necessary temperament for the successful management of natives—a sympathetic frame of mind combined with decision and firmness—cannot be taught in any lecture hall or laboratory. Physics would include agricultural engineering and the application of explosives and electricity to agriculture.

THE STAFF.

It is essential that the Principal should be an organiser, an educationalist and a specialist in tropical agriculture; not only a trained scientific agriculturist, but a thoroughly practical and experienced man. Much will depend upon getting the right man for the Head of the College and generous provision should be made to attract the best man available.

The staff would be something as follows :—

The Principal

Tropical Agriculture.
Lecturer
Plantation Instructor
(Assisted by staff of Department)

Chemistry and Soil Bacteriology.
Lecturer
Demonstrator
(Assisted by staff of Department)

Botany and Mycology.
Lecturer
Asst. do
(Assisted by staff of Department)

Zoology and Entomology.
Lecturer
(Assisted by staff of Department)

Horticulture.
Lecturer
(Assisted by staff of Department)

Irrigation.
(Visiting Lecturer)

Veterinary Science.
(Visiting Lecturer)

Physics, Land Surveying, Mechanics, Meteorology.
Lecturer.

There would still remain Geology, Poultry Farming, Apiculture, Bookkeeping to fit in as we found it convenient. A Secretary, Bursar and clerical staff would also be required.

THE COURSE.

The lectures should be so arranged as to provide for two groups of students. Men with degrees or diplomas in agriculture requiring to specialise in tropical agriculture would confine themselves to the study of the cultivation of tropical agricultural products in the lecture halls and plantations. All

other subjects they could neglect except a little specialising in Botany, Mycology and Entomology. These students could go through perhaps in a year. Students who had taken a scientific course in a college or had passed the London Matriculation, for example, but with no training at all in agriculture, would be required to take the full Agricultural and Horticultural course inside and outside. This would occupy two years at least.

Work outside in the plantations will constitute an important and essential feature of the course but whether it will be found better to have the students out for whole days or parts of days: in the mornings or afternoons: altogether or by alternate years; must be left for future decision and experience. We must bear in mind we are in a tropical country and that we must be careful about exposing young men to the sun. There would probably be five full working days in the week, Saturdays being kept free and available for expeditions.

If we found the college filled up with these two classes of students others would of necessity be shut out, but I think it would be a pity to begin by drawing too hard and fast a line. Though at one end we wish to turn out well equipped men for careers in Tropical Agriculture, at the other it will be very desirable to fill the college. I think therefore that at first we should not be too particular in insisting that all students should have had a scientific training before being admitted. If room were available students with no scientific training might be received provided they immediately began a preliminary scientific course at some institution where elementary science courses are given. A syllabus of lectures could be drawn up but I don't think it is desirable to do so at this stage because in establishing a College of Tropical Agriculture we should be breaking new ground and the whole question of the prospectus will have to be most carefully gone into before anything authoritative is published. This can only properly be done by some competent person devoting the whole of his time to the subject. Educational and technical authorities will have to be consulted. No one could be better qualified to undertake this work than the prospective Principal and as soon as the establishment of a college is decided upon the first step should be the seeking out and selecting of a Principal, before even a stone is laid, to come out and grow up as it were with the institution. He would devote himself to studying the planting industries of Ceylon, to the preparation of a prospectus and of plans for the organisation of the staff and work.

RESIDENT STUDENTS.

The College though primarily for the British Empire should be open to students of all nationalities if room permitted. In order that the education it provides might be available to the sons of those whose means are moderate the fees should be kept as low as possible and to permit of this one house should be arranged to accommodate students in dormitories. A second house would be necessary for those who perferred private rooms. If the fees of students in No.1 or the dormitory house were fixed at Rs.75/- per mensem those of No.2 house would be say Rs.150/- per mensem. It is suggested that to begin with accommodation might be provided for 50 students in No.1 house and 20 in No.2.

The income from fees on this scale would be Rs.80,000 per annum when the college was full.

NON-RESIDENT STUDENTS.

There are probably many people past the age (which might be put at say 23) at which they could be received as resident students but who might nevertheless like to attend some of the lectures; either a course occupying 6 months, or extension lectures in the evening. These could be arranged for at reduced fees; perhaps from Rs.30 to Rs.45 per mensem. The accommodation of non-resident students would no doubt be catered for by private enterprise.

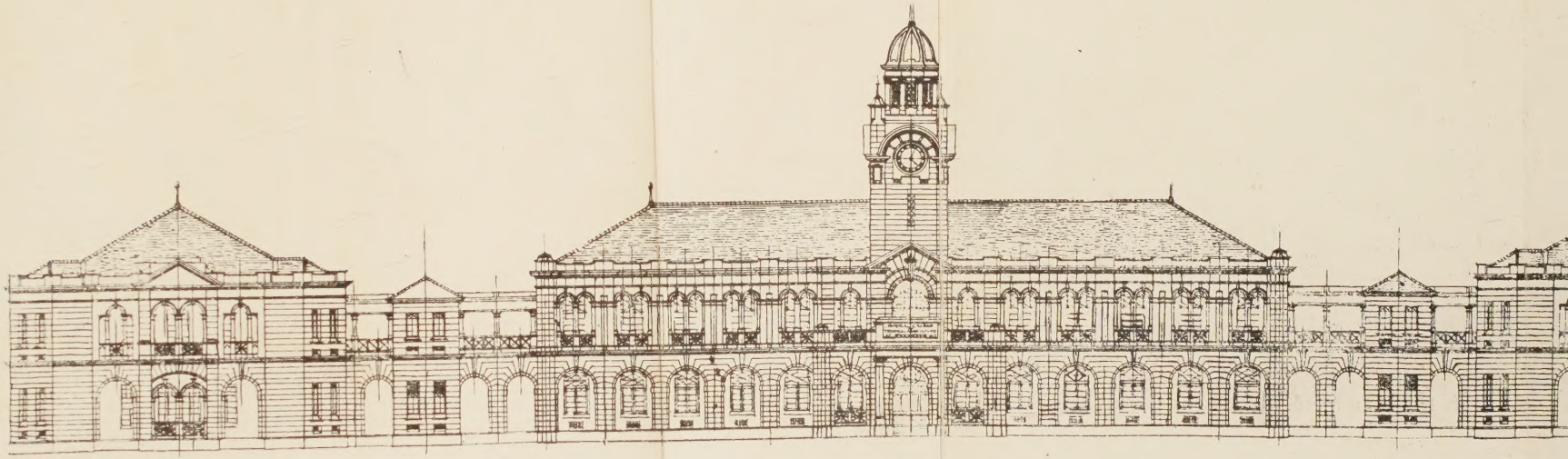
Such in brief and general terms is the proposal. But it is necessary to repeat that the scheme is put forward merely as a basis for deliberation and discussion.

There are many points about it upon which we should keep an open mind; such for example as the number of students to be provided for, the length of the course, the fees to be charged, the staff required; while, as I have already indicated, before the scheme could be ready for final adoption there is much ground to cover that has not even been touched upon here.

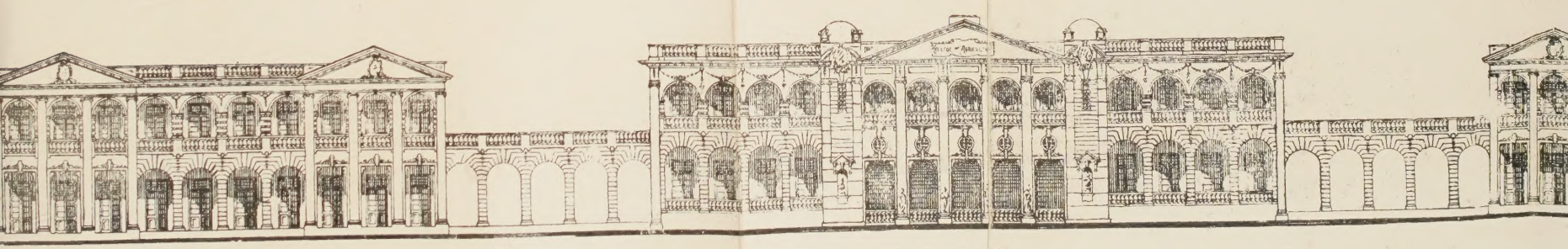
R. N. LYNE.

August 12, 1913.

Suggested Designs for Agricultural College at P



Mr. Claessen's Design.



Mr. Walker's Design.

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COCONUTS.

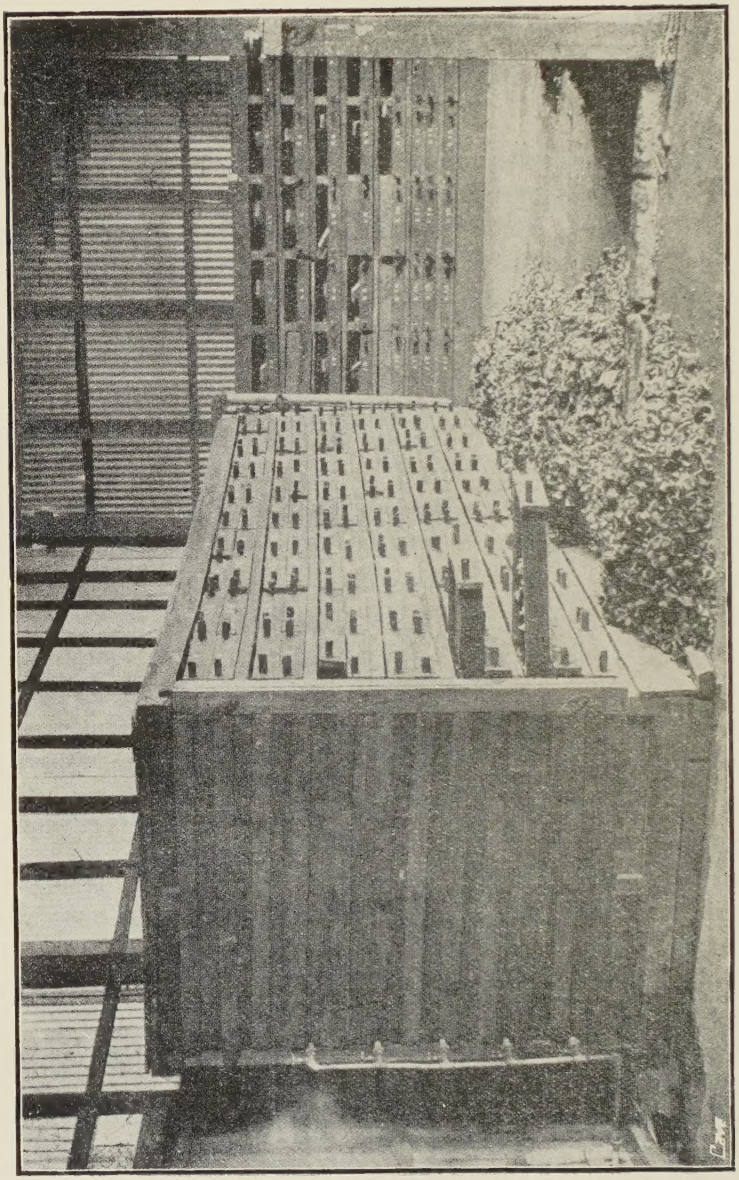
THE STEAM-PIPE HOT-OVEN COPRA DRIER.

The underlying principle in this apparatus is a simple steam boiler having a large fire box (to accommodate husks, shells, or other kind of bulky fuel) connected with an oven filled with sliding trays and one or several tiers of steam pipes; this drier costs very little for operation, the husks and the shells furnishing a super-abundance of fuel, the steam pressure being low, and there are no bearings to wear out. The bottoms of the trays, which may be made of any convenient size, should be of bamboo latticework or of galvanized-wire screen; no iron should be used on account of its blackening effect on the "meat" coming in contact with it. The oven itself may be made of any light wood and no special care is needed in its construction. The cool air enters around and beneath the trays in the lower portion of the oven, while the hot moist air from the copra rushes out at the top. (See illustration.)

A temperature of 50° to 70° C. (say, 120° to 160° F.) is sufficient thoroughly to dry copra in this oven in fourteen to eighteen hours; above 75° C. (170° F.), there is some danger of scorching or rather browning the material in the trays, even if they are made (as they should be) of split bamboo or light wood. This machine, however, may be and is misused. The copra can be removed *in eight hours* and sold on a par with the tapahan article, which it excels only in point of being unsmoked and evenly dried.

In passing it may be mentioned that there seems to exist a belief among the planters and copra dealers in Ceylon to the effect that any high temperature is liable to volatilize a portion of the oil in the "meat." While it is true that many oils are in a measure volatile at ordinary and oxidizable at high temperatures,those of the coconut type are practically stable. The real trouble behind a copra dealer's being afraid of "machine-made" copra is based upon the fact that, bulk for bulk, such copra is, of course, considerably lighter than that made by either the sun-drying or kiln process; being accustomed to a heavy article the dealer naturally jumps to the conclusion that if it requires more nuts to fill a full weight picul sack with "machine-made" copra, there has been a loss of oil and not merely one of water. Until the dealers, then, can prove that bulk for bulk the artificially dried copra contains less oil than the ordinary article, the copra maker should put down all adverse criticisms, which occur in practically every new feature of any industry, as being due to an instinctive prejudice against anything which upsets the old and familiar scheme of things.

PLATE XIII.



MODERN COPRA DRIER, THE BONITO STEAM-PIPE-OVEN TYPE.
Oven contains 117 trays, capacity 50 piculs per day. Magdalena, Laguna.

On large estates, the construction of a spacious drying house is recommended ; this may contain three to six floors which should be constructed of bamboo or palm latticework. From one or more large furnaces just outside this building hot dry air is drawn into the interior and forced up through the several layers of copra, a tall chimney giving a strong draft to accelerate the evaporation. If carefully managed, there should be no danger of scorching any of the material, even on the lower floors, since only a comparatively low temperature is required, provided the current of air is strong. Such a system naturally requires considerably more time than the steam-pipe-hot-oven apparatus, but this is a secondary consideration where very large quantities of the raw product are to be handled ; from one to two full days (night shifts required) should suffice to thoroughly dry the copra. The disadvantages of this system are: The ventilating fans require considerable power which could not very conveniently be obtained direct from the furnaces; the bringing in of the raw "meat" and the taking out of the cured product require mechanical conveyors of some sort ; the removal of the copra on any given floor which may become dry before that on a higher or lower floor would be difficult since it would not be very pleasant for labourers to work inside the building while the hot air was turned on—yet even this could not be much worse than the smoke of the tapahan drying-house.

The public and the trade, then, must know that the clean, un-smoked copra is not only worth more *per se* than either the sand-covered, sun-dried or the rotting kiln-dried stuff, but the artificially dried product can be kept in the bodega for several months if the producer desires to hold it on any question of price or weather.

The world's markets are hungry for good copra : the demand for A. I dry unsmoked non-mouldy copra will increase, and while the supply is increasing rather rapidly, it is believed that the price has not yet reached the high water mark. As soon as the first class grades are obtainable in fair quantities, however, the price of the low grades will have to drop considerably. It therefore behoves the planter to lose no time in improving his methods of drying so that in the near future the dealer can list him and favour him as a clean copra producer.—*The Philippine Coconut Industry*, by O. W. Barrett.

THE SPELLING OF "COCONUT."

The Editor of the Tropical Agriculturist.

Dear Sir,

The following from the Ceylon Morning Leader will prove of interest to your readers:— "The Spelling of Coconut.'— Sir Everard im Thurn, speaking at the Royal Horticultural Society, said the nut now known as 'coconut' was similar to the face of a monkey, and so the Spanish word 'coco,' meaning a grin or grimace, was attached to it. When Dr. Johnson was writing his famous dictionary he had an article on the 'Coconut,' but a careless proof reader passed a mistake in the spelling of the word, the compositor having inserted an 'a' and the word appeared as 'cocoanut.' This spelling became general, but the nuts are now known as 'coconuts,' 'kokernuts,' and 'kokers.'"

The present universal spelling "coconut" is rightly claimed to have originated with the *Tropical Agriculturist* and the general adoption of the spelling, dropping the extra "a," has materially assisted in establishing the spelling in newspapers and magazines all the world over—the more recent but illogical American "kokers" and "kokernuts" notwithstanding; as this form not only gives a longer sound to the word than is otherwise given it but would appear to the average reader an entirely new product.

But there are other relative forms of spellings which are often confusing and misleading—not variations regarding one article but various articles being known by similar names. This fact deserves the serious attention of experts who should agree to adopt names that would avert confusion.

I refer to the "Cocoa" as still to be seen in the writings of an older generation before *nut* in referring to the Coconut (*Cocos nucifera*); "Cocoa" and "Cacao" meaning the "Chocolate fruit"—as is often heard in the streets of Colombo and occasionally even at Peradeniya on passenger days—(*Thebroma, Cacao*); and "Coca" (*Erythroxylon coca*).

Mr. O. W. Barrett I think it was who in the course of a treatise on the subject stated that in dealing with *Cacao* from an agricultural and botanical point of view he would leave the manufacturer to deal with "Cocoa" —indicating the origin of the irregular form.

Now that we have "Coconut" fixed and in universal use, and "Coca" not being likely to change, will it not be more in keeping with science to do away with "Cocoa" altogether and substitute the more correct form "Cacao" which will leave 3 articles that are at present often confused with one another, on separate forms of spelling and pronunciation, with the least possibility of confusion?

I suggest the *Tropical Agriculturist* give the lead in adopting *Cacao* as the proper spelling, so that we may have :—

Cacao (*Theobroma, cacao*)
Coca (*Erythroxylon coca*)
Coconut (*Cocos nucifera*).

Yours Faithfully,
J. S. de SILVA.

[Our correspondent is not quite correct in stating that *Coconut* is the universal spelling. Probably the vast majority of people spell the word with an *a*. Turning up the Stores List we find "Cocoanut biscuits;" "Cocoanut oil;" and confectioners and traders throughout the United Kingdom would spell the word in the same way. Again, while *Coconut* is probably more correct, *Cocoanut* is certainly not incorrect. Thus the Century Dictionary after an exhaustive explanation of the origin of the two forms of spelling adopts *Cocoanut* in the text. Nor are we prepared to scrape the word *Cocoa* especially as *Cacao* is generally mispronounced. Indeed if we are to come to origins, the ultimate criterion after all of what is correct, *coconut*, *cocoanut*, *cocoa*, *cacao* would all go overboard as designations of trees. The coconut palm was at one time called the *cocoa-tree;* cocoa or cacao, whichever is preferred, the *chocolate-tree*, and is so called now in some countries.— Ed. T. A.]

COCONUTS AND THEIR YIELD.

THE ADVANTAGES OF MANURE.

Regarding actual yields of coconut palms, we see that the Kirivaula Coconut Plantation obtained 241,206 nuts from 7,591 trees, or an average of 32 nuts per tree, as compared with 44 nuts in 1911. This falling off, instead of an increase, was entirely due to the extreme drought that had been experienced, and had it not been for the manuring operations of the two previous years, Kirivaula would have done even worse. It is interesting further to note that out of the 241,206 nuts obtained, 31,666 made 22 candies (candy=560 lb., or 5 cwt.) and 150 lbs. copra, which realized an average nett price of Rs. 85·14 per candy; 107,870 nuts were sold at a nett average price of Rs. 55·14 cents (Rs. 1*s.* 4*d.*, 100 cents to the rupee); 5,000 nuts were planted; 6,670 were rejections (about 2½ per cent).

This accounts for only 161,206 nuts, so possibly some of the figures are incorrect; for instance, if 197,870 nuts had been sold, and not 107,870 as stated, that would make up the 241,206 nuts plucked. The details given show, however, how a crop is divided up. The management of this company further report that during 1912 the bearing and blossoming palms on the portion of the estate south of the Deduru Oya (river) were manured and good results are expected. It is proposed to deal with the trees on the north of the river in the current year. Buffaloes have also been used for manuring purposes by tying them to trees at night. Regarding the portion of the estate manured in 1912, the Visiting Agent, in his December Report, writes: "The older palms are much finer now than they were a year ago, and their crowns have developed very much. There is no sign of any yellow about them and given an adherence to the present programme of manure I am sure these trees will yield heavy crops in the future. Supplying has again been rather disappointing, and white ants have done damage to the young plants put out, but by putting in older plants, and with the use of 'kainit' with supplies, it is hoped to get over this difficulty during the current year. Digging round palms continues to be done, and in general the condition of the estate is satisfactory."

The coconut crop of the Jambulande Tea and Rubber Company (Ceylon) was also below the estimate on account of the unfavourable weather.

The Hon. Mr. W. H. Figg, speaking as Chairman of the Coconut Estates of Perak, of which company Mr. Kelway Bamber is also a Director, said those present "would understand that to give details of the working of a place at such a distance and practically in a new district, was somewhat difficult. Means of communication were not easy and the management of coolies in a new district was a matter of trouble. The opening up of the Bagan-Datoh district was a pioneering enterprise and, taking all the facts into consideration he thought the shareholders might be satisfied with what had been done. Personally he believed that having accomplished the draining and the satisfactory planting of the 4,500 acres they had a very sound investment at quite a reasonable cost. Some shareholders had asked what would be the ultimate cost per acre. In the prospectus they anticipated that it would be possible to bring it to the producing stage for £20 an acre. In consequence,

however, of the competition for labour, &c., it might come to one or two pounds more. In any case it seemed to him that it would be possible for a matter of £25 per acre inclusive of the purchase of the land to complete the work they had in hand. To have successful clearings at £25 per acre in a good situation, and with such a soil as they had in the Bagan-Datoh district was, it seemed to him, as good an investment as anyone could wish to have." —Tropical Life.

COCONUTS IN MALAYA.

PRACTICAL REVIEW OF THE CONDITIONS AND PROSPECTS.

BY H. LAKE COGHLAN.

Remarkable attention is being directed towards the coconut industry, and on all sides one hears of the boom that is at hand. The company promoter is busy preparing his nets for the promised good time, and the ex-tropical man will, as usual, have an option ready, or know of a friend who has one. It may not be out of place therefore to put on record a few remarks of a precautionary nature.

Malaya--the successful rubber and tin country—is also an ideal land for the cultivation of the coconut, its equable tropical climate, its rich alluvial soil, its plentiful and evenly-distributed rainfall, and its ozone-laden breezes all making for rapid and prolific growth. It must be remembered, though, that in the past Europeans have not given this particular cultivation the same attention that has been devoted to rubber and coffee, and consequently the industry has been confined almost entirely to the efforts of the natives. This will account for most of the coconut estates in Malaya being in the hands of Malays or Chinese. The plantings are more or less limited to the Kampongs, or villages in regions near the sea or on neighbouring islands. The titles usually take the form of mukim permits, or short agricultural leases, for blocks often as small as five acres, and, in order to obtain an estate of any magnitude, it may be necessary to embrace 200 or 300 holdings. This is mentioned to show that at the present time, in Malaya, even though in the whole territory it is estimated there are about 150,000 acres under coconuts, it is difficult to find a plantation in bearing of 500 acres and upwards, held under single ownership or under a modern title readily negotiable. The Government does not look with favour upon natives parting with their holdings, and even when one has overcome the difficulty of getting actual owners' (not squatters') signatures to a sale agreement, official transfer may be delayed, or even refused, on the ground of non-compliance in the past with cultivation covenants, or more likely quit rents in arrear. Therefore it behoves one to move cautiously when dealing with schemes sent here for flotation.

Before parting with any cash, a few pertinent questions to ask are:—

(1) Is the estate in one block ? if not, in how many blocks, and are they contiguous ?

(2) How many owners are there ?

(3) If native-owned, have signatures been attested by the Penghulu, or native headman, of the district ?

(4) Was each owner given a consideration ?

(5) Has the proposed sale the approval of the British Resident of the State ?

The questions satisfactorily answered, one might proceed to obtain the expert report ; but before this cost is incurred vendors should be in a position to state, on independent evidence, the following:—

(1) Age of trees ; number per acre.

(2) Nature of soil ; if peaty, whether it has been limed.

(3) When and how manured.

(4) What precautions have been taken against red beetles.

(5) If there are catch crops, particulars of them and revenue.

(6) If there are squatters, what rights or sub-leases they have.

(7) The average nuts per tree per picking, number of pickings per annum, evidenced by sales of nuts or copra.

THE EXPERT.

In choosing an expert to make a report, a London buyer would do well to bear in mind that in Malaya there are few planters intimately acquainted with the coconut industry, and fewer still who can speak from personal experience in the actual planting of the nut, from seed to copra. As planters, however, they have had the experience of local conditions; of soils and manures; of the comparisons of one estate with another, and they should be judges of areas. For the remaining details which usually go to make up a report they turn, as every one does, to Chamber of Commerce statistics and published handbooks. Regarding the latter, too, a word is necessary. Recently there was published in London a remarkably well-compiled book on the coconut industry. It contains a wonderful collection of useful information, but does not embrace Malaya, where the best nuts are grown. It is compiled generally from Government statistics, and seems to leave little untold. In it an estimate is given, as an extract "from a Government report," on the cost of planting and bringing into bearing an area of 500 acres; and the cost per acre at the end of the sixth year is put at £13. Now, this cannot be done in Malaya; for official figures there put the cost at about £25 per acre. This figure is certainly on the high side; as, in the opinion of experienced planters, who in coconuts dispense with fancy work, £20 per acre should not be exceeded.

STOCKS OF COPRA.

Another point to be remembered in connection with this industry is the fact that unlimited supplies of copra are not waiting in Malaya to be bought cheaply from inexperienced natives. Copra sales are largely in the hands of Chinese produce dealers, who are astute men of business. They have English-speaking clerks, who are familiar with market prices, and are accustomed to receive daily bids for their produce from European firms representing big British and continental trading companies. People on this side, therefore, should not be misled by haphazard statements regarding untold quantities of

copra only awaiting capital to purchase it. Malaya came through the rubber boom without a blemish. Speculators may have lost money in shares and crazy finance, or through irresponsible valuations and reports; but one cannot recall a case of deliberate misrepresentation. The country may rightly be termed the Land of Promise, and now that a few words of warning have been put on record we may turn to the attractive side of the subject.

COCONUTS AS AN ATTRACTIVE INVESTMENT.

There are large tracts of land, rich in alluvial soil, in Malaya, well suited for coconuts, and these await the advent of enterprising capitalists. The industry in itself is but in its infancy, and, is bound to expand on the introduction of more enlightened methods for the preparation of copra, the extraction of oil, the ever-increasing demand for fats for human consumption (such as margarine or nut-butter), and the enormous requirements of the soap trade, to say nothing of the products used in the manufacture of biscuits, confectionery, cattle food-cake, coir fibre, and yarns.

A foreword written recently by SIR WIILLIAM LEVER, one of the greatest soap manufacturers, says: "I know of no field of tropical agriculture that is so promising at the present moment as coconut planting, and I do not think that in the whole world there is a promise of so lucrative an investment of time and money as in this industry."

At present the exports from Malaya are:—

Coconuts, value	$305,452
Coconut oil	$2,218,436
Copra	$18,429,954
Total	$20,953,842

or about £2,500,000 sterling. This is bound to increase enormously in the near future, and in British Malaya—"the Golden Chersonese," as it is called—is held out the promise of fortune beyond ordinary conception; but one can only go there on somewhat prepared lines, and with capital, not necessarily large, but sufficient to deal with at least 500 acres of land. Some London rubber agencies have as many as a hundred applicants, mostly public-school boys, waiting for a vacancy to occur out East: men who recognise that the old professions in England are played out; that for young fellows of stability and ambition new fields must be found. Planting attracts them because of its open-air life, its constant and varied occupation and, in leisure moments, excellent shooting, and in due course splendid returns on their outlay :—THE FINANCIAL NEWS.

THE PREPARATION OF COPRA.

In their issue for June the *Agricultural Journal of the Companhia de Mocambique* has the following in an article on Copra: In order to dry his copra Mr. Wright, a planter near Mirigama, employs a sort of oven, in which the nuts are placed in layers about 20 centimetres deep, after they have been cut in two and the fibre removed. They are then laid on metal bars placed at short intervals from each other, the inside of the kernels downwards. The

oven is heated with the shells which make excellent fuel, as they burn steadily. The shrinkage caused by the evaporation of the moisture held in the kernel enables the pieces of copra to be easily removed.

Hot air driers for copra are not yet commonly used, but it is probable that their use will become general on estates managed by Europeans, as they enable one to produce a uniform article and one which is thoroughly dry. Some plantations in Trinidad, West Indies, are now beginning to make use of this improved method, as is also the German Trading and Planting Company of the South Seas, which has planted the enormous coconut groves in Samoa. In cases where it is acknowledged to be advantageous to prepare copra by exposing it for a time to the sun, it is advisable to adopt the type of free air drier used in Java for the purpose of drying cinchona bark. This system has the advantage of being economical.

In the case of very extensive plantations one can use free air driers as described by Mr. Elot in his pamphlet on cacao and other important crops of Trinidad. These driers are made of large metal roofs which can be moved on rails. This enables one to expose the copra while the sun shines and to put it under shelter at the least sign of rain. According to Dr. Davillé the method of working in Tahiti and the neighbouring islands is somewhat different. The natives split the whole fruit into two pieces by striking them lengthwise with a hatchet. By means of a knife or pointed bone they then lift a piece of fibre one centimetre broad from the outer surface of each half nut, to enable them to re-unite the halves, tie them together in pairs, and suspend them on cords, wires or creepers stretched horizontally, taking care to fasten so that the inside of the nuts is turned towards the sun and to put them as far as possible in places sheltered from rain. At the end of 2, 3 or 4 days, depending on the weather, the copra falls to the ground of its own accord. The natives then gather up all the pieces and make holes in them, stringing them on small cords, so as to make a kind of large necklace consisting of spherical caps fitting into each other. The copra from these places is generally sent to San Francisco in this form, i. e. without any further breaking.

SMOKE DESICCATION.

The method of preparation called by Dr. Davillé "Smoke Desiccation" may also be used. It is described in his work on the cultivation of the coconut, which was written in 1899. This method consists of drying the kernels, after they have been broken in two, in a kind of hut, which is generally termed a "Smoke house." These huts are about 10 metres long by 5 metres broad, and are made of solid wooden posts sunk a metre deep in the earth, bound by cross pieces and supporting a light roof, the lower edge of which is 2½ metres above the ground. The walls are made of corrugated iron sheets, nailed to the posts which support the roof; the ceiling is made of sticks of preferably of metal rods one centimetre in diameter, placed 3 or 4 centimetres apart and supported here and there by uprights. Then shallow holes, in which the shells or wood used as fuel are placed, are dug out in the floor at a distance of one metre from each other. After removing the fibre the coconuts are broken and then laid out in regular layers 20-25 centimetres deep, upon the lathes or bars forming the ceiling. The fire is then lighted,

and the "Smoke house" carefully closed. At the end of two or three days, drying is generally well advanced. The copra is then withdrawn and removed from the shells, using a knife or piece of pointed wood if the kernels still adhere to them. It is also posssible, as Dr. Davillé remarks, to replace the smoke-house by similar but less expensive buildings, by digging a big ditch two metres deep over which is laid, resting on the ground, a floor with openings similar to those which have just been described. The whole is then surmounted by a small roof approximately two metres high. The bottom of the ditch serves as the hearth. Desiccation under these conditions takes a longer time than in a smoke house of corrugated iron.

Whatever precautions are taken in preparing copra by drying it with smoke, it is almost impossible to obtain a product of really good quality. It is, therefore, advisable only to employ this method when it is impossible to do otherwise, and to give preference to drying in the sun, ovens or stoves, which tend to prepare a product of a very pale colour, for which there is always a sale at very remunerative prices.

The care bestowed on the preparation of copra always has considerable influence on the value and quality of the products—oil and cake—derived from it. The extra price value may reach and even exceed £2 per ton, and it will doubtless continue increasing more and more, for the manufacture of very white and pure oils, of soap of superior quality, and above all of coconut butter (vegetaline, palmerine, etc.,), tends to expand every day. It is therefore essential that planters should aim at producing only thoroughly dry copra of good quality and as little discoloured as possible.

The planters in the English Colonies in the Far East have long recognised the care which they must bestow upon the manufacture of copra. Their attention was drawn to this point by the superiority of the oil and dried kernels coming from Cochin (which is situated on the West Coast of British India and a little to the North of Cape Comorin), which to-day have a great reputation, and which always reach, both on the Marseilles and London markets, a much higher figure than the same products of any other country. This difference sometimes reaches nearly £4 a ton. For instance, in November, 1910, Cochin oil was quoted at Marseilles at £26. 5*s* per ton, although the market price of ordinary coconut oil did not exceed £22.12*s*.6*d* per ton. The planters of Ceylon, which is situated only a short distance from Cochin, were the first to be roused to this state of affairs, and they endeavoured to find out to what this superiority was due. At first it was attributed to climate and soil, but the investigations carried out by the efforts of the *Tropical Agriculturist* seem to prove that the value of Cochin copra and oil is due to the care with which the nuts are harvested and dried. The following conclusions may be drawn from the investigations :—

1. The purest oils and those of the best quality are extracted from the least discoloured copra, which is only obtainable from nuts harvested when thoroughly ripe.
2. Drying by smoke and in ovens when badly carried out is objectionable, as it gives rise to more or less darkly-coloured copra, which emits a decided smell of smoke, leaving a residual cake of inferior feeding quality.

3. Sun-drying gives excellent results when properly carried out.
4. Copra of excellent quality can only be prepared from thoroughly ripe nuts.

5. Preparation by exposure to the sun is carried out with the greatest care by the natives of Cochin, who are more energetic and perhaps also better agriculturists than the Singhalese. They, too, take care to prepare their copra and oil from only those nuts which are thoroughly ripe.

The drier the country in which the estate is situated, the easier the preparation of sun-dried copra, so that this method will not have any serious difficulty to contend with on the western slopes of Madagascar. It will, perhaps, require, as in some districts of Ceylon, special arrangements on the East Coast, where the rains are so frequent. In this locality the Cinchona driers of Java, to which we have already referred, might be advantageously used, or preferably, when the importance of the industry warrants it, suitable hot air stoves, which have the great advantage of allowing rapid desiccation at all times, might be started. In very wet countries and when it is impossible to go to the expense of stoves, it is advisable to make copra in ovens, provided that fuel giving off the minimum amount of smoke be used.

These various points make us attach great inportance to the lesser details of sun-drying, which, according to the care taken, will produce either the best or very inferior copra. According to an experienced Ceylon planter the following procedure is recommended. Thoroughly ripe nuts are first selected and gathered only when of a dark brown colour. They are then placed in heaps until it is time to start the drying, which must be begun within three or four weeks of picking. At this time the kernels may be easily removed from the shell after short exposure to the sun, and often when the nut is first opened. The nuts must then be broken and spread out side by side right in the sun on a day as dry and hot as possible, taking care to prevent any particle of dirt or sand coming in contact with the inside of the kernel. It is, therefore, a good plan to spread out the copra on mats until a dry film, to which foreign matter cannot adhere, is formed by evaporation on the inside of the kernel. By rubbing the copra gently with the fingers sand is easily removed. At the end of a few hours this operation is usually complete. Then the pieces of hard shell are removed and the drying finished by spreading the copra out in a suitable place either on mats or on the ground. The nuts must only be opened during the morning to allow the surface crust to form before night. A little before sunset the kernels are placed in long heaps thirty to forty centimetres high. On the next and following days they are again spread out until drying is complete. Rain even of soft duration will do much damage to the colour of copra. Shelters into which the nuts can be quickly removed when the weather is threatening, seem to be indispensable on the entire east coast of Madagascar.

CONCLUSION.

At the present time sun-drying is certainly the best method for use on the western slope of Madagascar. It must, however, be carefully carried out. This method will give equally good results at certain places on the east coast the island, provided that drying rooms with shelters are erected; but in

many places, and especially during the rainy season, the preparation of copra by means of ovens and the use of hot air stoves is preferable.

It is needless to add that the returns are very variable. In Ceylon it is estimated that 4,800 to 5,500 nuts are required to produce one ton of copra. In Trinidad 6,000 are taken as the average. In this connection it is interesting to note the experiments carried out by M. Rideau, a planter in Annam, which was published in 1901 in the "Revues des Cultures Coloniales." These experiments were carried out on 1,000 coconuts, and were repeated each month for a whole year.

The quantity of copra produced by 1,000 nuts and the number of nuts required to yield one ton of copra were as follows:—

	Month.	Kilos of fresh kernels from 1,000 nuts.	Kilos of copra from 1,000 nuts.	Number of nuts required to make one ton of copra.
Winter Season	November	316·0	175·3	5,704
	December	315·8	179·2	5,580
	January	321·5	160·4	6,234
	February	330·5	173·5	5,763
	March	338·0	173·5	5,763
	April	345·0	167·3	5,977
Summer Season.	May	425·0	196·5	5,089
	June	340·0	168·0	5,780
	July	328·0	176·0	5,680
	August	312·0	181·0	5,524
	September	325·0	182·0	5,494
	October	396·0	173·0	5,780

Taking to the average for the 12 months, 1,000 nuts yielded 332 kilos (730 lb.) of fresh kernels, and 175 kilos (385 lb.) of copra. To produce one ton of copra an average of 5,677 nuts were required, that is 2·53 nuts produced 1 lb., or 5·57 nuts one kilo of copra.

The above notes on the manufacture of copra have been taken and translated from "Le Cocotier," a standard work on coconuts by M. Prudhomme, Director of Agriculture for Madagascar, to whom our grateful acknowledgments are due.

RUBBER.

CEYLON YIELDS AND TAPPING METHODS.

A NEW TAPPING SYSTEM.

Mr. Joseph Fraser, at the London Meeting of the Neboda Company, gave some interesting information with regard to the Narthupana Estate belonging to the Company. The following shows the magnificent yields being obtained from this plantation which is situated in the Kalutara District, one of the best rubber growing districts in Ceylon.

AVERAGE YIELDS.

Acres.	Per acre.	
73	612 lbs.	1904 planting
52	570 ,,	1902 to 1905
44	339 ,,	late 1905 planting
169 Average	528 ,,	
30 ,,	31 ,,	(30% of trees tapped for six months)
199		

On Narthupana these 169 acres have been manured yearly, and in 1912 the whole area was

TAPPED ON THE ONE CUT SYSTEM

half spiral left of the channel, with hangers suspended under the spout, costing 56 cents to 60 cents per acre. Mr. Fraser claims that this system possesses the manifest advantages of high yields, small consumption of bark, low cost of tapping while the risk of possible damage to the cambium is reduced to the minimum and the amount of scrap reduced to the lowest possible point. The area excised in tapping is only three inches per annum, when the coolies are properly trained. Fewer coolies are required, one tapping cooly for every three acres being sufficient, which means better pay can be given to the coolies. Under this system well grown rubber, giving high yields, can be tapped and scrapped at a cost of 8 cents to 10 cents per lb. With coolies earning on an average 50 cents to 60 cents per day, labour difficulties should gradually disappear together with the highly objectionable system of high advances. The total cost of tapping and scrapping, including the areas in partial bearing in 1912, amounted to 19·4 cents per lb.

For 1912 Neboda harvested 168,833 lbs. of rubber. This realised 4*s*.5·4*d*. per lb. in London. The F.O.B. Colombo cost was 9·7*d* per lb. The all in charges, including freight and brokerage, amounted to 1*s*.1·38*d*. per lb., leaving a gross profit of 3*s*.3·95*d*., the highest rate yet earned by any Company for 1912:—Grenier's Rubber News.

RUBBER VINE CULTIVATION IN THE BAHAMAS.

Mr. Henry D. Baker, American Consul on Special Service in India, has furnished us with a copy of the Daily Consular and Trade Reports issued by the Bureau of Foreign and Domestic Commerce Department of Commerce and Labour, Washington. Among the several articles there is an account on "Rubber Vine Cultivation in the Bahamas" by Mr. Baker. He says that plans are pending for an extensive cultivation in the Bahama Islands of the rubber vine known as *Cryptostegia grandiflora*. A $500,000 syndicate having this object in view was organized several months ago in Boston, and about 1,100 acres of land have been purchased near the city of Nassau in the Island of New Providence. A large number of shoots to be planted over this land will shortly arrive from Mexico, and special machinery for extracting the rubber and fibrous by-products by a secret process has been ordered from the United States.

It is understood that approximately 5,000 rubber vines will be planted to the acre. After six months' growth the rubber vine is said to be 12 to 30 feet long. The vines will be cut in about 12 months, when there will be presumably 2 pounds of shrub to the plant as a minimum, yielding about 2 per cent. of rubber, or 200 pounds of rubber to an acre.

EXTRACTION METHODS AND VALUABLE BY-PRODUCTS.

The rubber juice is contained chiefly in the lactiferous ducts of the bark, but to some extent also in the wood of the stem; in fact, the entire plant contains a certain amount of rubber. While the process of extraction is secret, yet in the main it appears that it is analogous to the production of sugar from sugar cane, the rubber vine being ground up and the juice extracted as from sugar cane. Samples of rubber thus obtained from the rubber vine are estimated as worth in the London market within 8 cents per pound of the price of the best Para Rubber.

The fibrous by-products of the rubber vine are considered as possessing an importance possibly greater even than that of the rubber itself. The bark of the vine yields 6 per cent. of the weight of the whole stem in a pure cellulose fibre, undignified and having silky lustre comparable to Japanese ramie fibre and almost equal to cotton. It is thought that it can be used as a substitute for Egyptian cotton, especially in the manufacture of fine underwear and other textile goods. The pods of the rubber vine, besides containing a fair percentage of juice, have large quantities of a silky cotton, such as would be suitable for stuffing pillows; when refined and specially treated it can be successfully spun with ordinary cotton. There are 5 to 10 pods to each shrub. The woody substance of the rubber vine when bleached and worked out yields a fibre suitable for paper pulp. The vine can be best harvested after the fruiting period.

PONGOLO RUBBER ESTATES.

ARRIVAL OF MACHINERY.

Amongst the new plant is a wonderful invention known as the "creeping grip." This machine is used for ploughing, haulage, and all kinds of estate work. It lays its own track over sand and through all sorts of rough country. It weighs only 7½ tons, and not only does it do its work over soft sand but is capable of hauling 15 tons weight under such adverse conditions, the cargo being carried by means of broad 14-inch tyred wheels. The invention, which is an American one, has been operated successfully under the same conditions as obtain at the Pongolo Rubber Estates.—Lourenco Marquees Guardian.

THE DIGESTIVE JUICES OF PLANTS.

It has long been known that both plants and animals carry on their various chemical operations by means of specific agents known as enzymes. Thus, when a plant requires the starch which is stored in its leaf, tuber or elsewhere, a special enzyme, diastase, is put in contact with the starch grains, corrodes them, and converts the starch into sugar. The mode whereby the animal makes use of the starch which occurs in its food is precisely similar to that employed by the plant. Both saliva and pancreatic juice contain diastase, and hence such starch as escapes the action of saliva—and in these days of quick lunches much escapes—is acted on by the diastase of pancreatic juice and is hydrolysed to sugar. Each of the many chemical actions which go on in the body is presided over by a specific enzyme, of which the starch-converting diastase may serve as an example. The digestion of proteins—the complex nitrogen-containing substances which are of special nutritive value is effected by stages, and for each stage there is a special enzyme. In the animal these proteolytic enzymes are contained in the gastric and pancreatic juices. Since the processes of digestion are similar in plants and animals, we shall expect to find that proteolytic enzymes occur in plants as well as in animals. This expectation was realised long ago by the classical investigations on the substances excreted by insectivorous plants, such as Droser and the Pitcher plant (Nepenthes). These substances bring about the solution of proteins in a way similar in all essentials to that whereby the proteolytic enzymes of animals act.

The fact that the protein-digesting enzymes of plants are readily demonstrable in the case of insectivorous plants is apt to give rise to the idea that their occurrence is exceptional and bound up in some special way with the curious and uncanny habit of Nepenthes and Droser. This however, is not the case. What happens in these happens in all plants, and the only peculiarity of the insectivorous plant is that it produces—in accordance with its special habit—a relatively large and hence readily recognisable amount of proteolytic enzyme—Gardeners' Chronicle.

CACAO.

CACAO MANURING EXPERIMENTS IN DOMINICA

BY H. A. TEMPANY.

In 1900 an acre and a half of a 10-year old cacao plantation was laid out at the Botanic Station and divided into five plots, each of which has received a different manurial treatment applied annually from 1902 to 1912. The following are the average returns for the period :—

No. of Plot.	Manurial Treatment : cwt. per acre.	Wet cacao lb. per acre.	Dry cacao* lb. per acre.	Cost of manuring per acre.	Net gain† by manuring per acre.
				£. s. d.	£. s. d.
1	No manure ...	2,800	1 176	—	—
2	Basic phosphate 4 Sulphate of Potash 1½	3,369	1,415	2 5 3	3 14 3
3	Dried blood 4	3,261	1,370	1 16 0	3 1 0
4	Basic phosphate 4 Sulphate of Potash 1½ Dried Blood 4	3,876	1,628	4 1 3	7 4 9
5	Mulched with grass and leaves.	4,233	1,778	3 0 3	12 1 0

* Calculated from the wet yield assuming 42 lb. of cured cacao = 100 lb. wet cacao.
† Taking the value of cured cacao at 6*d*. per lb.

The artificial manures are distributed over the surface of the ground and lightly raked in. The mulch consists chiefly of grass from lawns, and leaves and pods of the saman tree (*Pithecolobium saman*), and is applied at the rate of 4 baskets of 20 lb. each to every tree. No forking has been performed since the beginning of the experiments.

The returns of the mulched plot have been uniformly highest, Plot 4 coming next in order, and in both these cases, the level of the yields was gradually increased during the first 5 or 6 years and then remained more or less stationary, fluctuating with the seasons. In the case of Plots 2 and 3, which receive incomplete dressings, and of Plot with no manure, there has been no accumulation of fertility ; but neither have the yields declined, though they may be expected to occur in future. The superiority of the treatment on Plot 5 is substantiated by the excellent appearance of the trees.

Two other experiments carried on at the Botanic Station during the years 1907-12 indicate (1) that mulching is equally efficacious on a steeply sloping hillside and on the flat, and (2) that a mulch of grass and leaves is superior to an application of 600 lb. per acre of cottonseed meal.—Monthly Bulletin.

THE NATURE OF CACAO FERMENTATION.

Recently communicated to the Chemical Society and published in their Journal for November 1912, is an important paper by Bainbridge and Davies (of Messrs. Rowntree & Co, Ltd.) entitled "The Essential Oil of Cocoa."

Much of the information it contains is purely of scientific interest, but those matters dealt with, which are likely to prove useful and interesting to the cacao grower have been abstracted as follows:—

The essential oil was obtained in the investigation by the distillation of cacao nibs. It possesses an intense odour of cacao, and the flavour was clearly perceptible in a dilution of 1 in 50 million parts of dilute syrup. The flavour is most nearly akin to that of coriander oil. It is pointed out that in the method of preparing cacao beans in the Tropics by fermentation and slow drying, a number of possible ethereal substances are added naturally to the crude oil. To explain this, a description is given of the different fermentation changes, as investigated by one of the authors in the West Indies.

The first runnings from the fermenting box contain alcohol, invert sugar and tartaric acid. Part of this liquor penetrates into the beans, but the shell membrane is fine enough to prevent the micro-organisms, which lead to the production of these substances, from percolating to the kernels.

During the first twenty-four hours of fermentation the temperature rises to 35°C. or 40°C., varying with the exact position of the box. Within forty-eight hours it rises to 40°C., to 45°C., and if the fermentation is continued for five or six days, the temperature will be found to rise to a maximum of 45°C., to 50°C. Higher temperatures are occasionally noted when the fermentation is continued for an exceptionally long period, for instance, ten to eleven days as in Trinidad. In this case, however, the temperature will fall towards the close. The bio-chemical nature of the different changes is explained as follows:—

(1) A large growth of *Saccharomycetes apiculatus* ('yeasts') together with small quantities of *S. anomalus*, doubtless derived from the surface of the pod husks. This stage lasts about twelve hours.

(2 As in spontaneous wine fermentation, an enormous development of true *Saccharomycetes* occurs. If the temperature rises there will be no formation of new cells after the first forty-eight hours. The alcohol produced soon arrests the growth of *S. apiculatus* and the 'wild' yeasts. A quantity of alcoholic liquor drains away.

(3) Acetic acid fermentation occurs. This is caused by *Bacillus aceti* brought in great numbers by swarms of the 'vinegar fly' (Drosophila). If the temperature does not rise above 50° C., the acetic bacteria continue to grow during the remainder of the fermentation.

(4) Finally, if the fermentation is prolonged beyond eight days a growth of spore-bearing bacili of the *Bacillus subtilis* type will take place.

In continuation the authors state: 'It is obvious that a number of the products resulting from these complex fermentations will percolate into the bean, and of these the less volatile constituents will remain on the dry kernel. Consequently we shall expect to find that the true essential oil of cocoa is accompanied by a certain number of esters and higher alcohols, analogous to those produced in other spontaneous fruit fermentations taking place at comparatively high temperatures in presence of a free supply of air.'

After describing the chemical and physical properties of the essential oil and other volatile products of cacao, the paper concludes with a summary, part of which is reproduced as follows:—

"(1) The aromatic principle of the cocoa bean is an essential oil. (2) Two thousand kilos of cocoa nibs (deprived of some cocoa butter) gave a yield of 24cc : of purified oil with a very powerful aroma and flavour of cocoa. (3) The oil was fractionally distilled three times and the third distillation yielded seven fractions. (4) The early fractions were rich in esters, derived in all probability from the fermentation of the cocoa bean. (5) The middle fractions were rich in *d*-linalool, corresponding closely with coriandrol. The total linalool represents more than 50 per cent. of the cocoa oil."—Agricultural News.

SHEEP RAISING THROUGHOUT THE WORLD.

The following extract and figures dealing with sheep farming are reproduced from the Berlin Journal *Die Ernaehrrng der Pflanze.*

Unfortunately with the progress of intensive agriculture in almost all countries the sheep breeding industry is retrograding, although there are a few exceptions, as, for instance, in England, where it is convincingly shown that such a state of affairs should not exist; on the contrary, that given the introduction of pure breeds, sheep-raising can be profitably carried on without too much outlay on management. Sheep breeding in Germany has to-day fallen to a point which thirty years ago would have appeared incredible; and if (excepting Russia), England, France, and the States of Southern Europe, now considerably surpass us, still, with them also the sheep industry is gradually drifting towards comparative insignificance. In reality, it is only in Australasia that sheep-breeding is still in full progress, for even Argentina and the United States have considerably reduced the numbers of this class of stock.

SHEEP OF THE WORLD.

1.	Argentine ...	67,211,754.	11.	Victoria ...	12,882,663.
2.	United States ...	52,262,000.	12.	Cape of Good Hope	11,796,790.
3.	New South Wales	45,560,969.	13.	Italy	11,162,926.
4.	Great Britain ...	26,494,992.	14.	Algeria ...	9,042,302.
5.	Uruguay ...	26,286,296.	15.	Hungary ...	8,547,366.
6.	New Zealand ...	23,996,126.	16.	Bulgaria ...	8,130,997.
7.	British India ...	23,246,636.	17.	Germany ...	7,703,710.
8.	Queensland ...	20,740,981.	18.	Turkey in Europe	6,912,568.
9.	France ...	17,110,760.	19.	Roumania ...	5,655,444.
10.	Spain	15,725,882.	20.	Austria ...	4,928,016.

COTTON.

THE BRITISH COTTON GROWING ASSOCIATION.

REPORT OF WORK IN INDIA AND CEYLON.

The following extracts are from the Eighth Annual Report for the twelve months ending December 31st, 1912, of the British Cotton Growing Association :—

As was stated in the last annual report, the offer made by the Association to commence direct operations in Sind with a view to ensuring that the native cultivators should be paid a suitable price for better qualities of cotton was not accepted by the Government of India, mainly in consequence of opposition from the Bombay spinners. It is understood that certain arrangements have been entered into by the Government with the Bombay spinners, and it is hoped that the producers will receive a fair price to compensate them for the extra labour and cost of growing improved varieties. The Council do not propose to take any further action in the matter.

The results in Ceylon have not been satisfactory, and the Council have decided to spend no more money in this Colony. They will, of course, be willing at all times to help in marketing cotton or in other ways, and to give such advice as may be needed on any samples of cotton.

DURANGO COTTON IN CALIFORNIA.

In the regions infested by the cotton boll weevil (*Anthonomous grandis*), the cultivation of the long-stapled cotton is seriously hindered by the fact that this cotton is mostly of late-maturing types, and consequently more severely injured by the parasite. The United States Department of Agriculture has therefore for several years past endeavoured to produce an early long-staple cotton. Among others thus produced the three following may be mentioned : Columbia, which was obtained by straight selection from a short-staple variety; Foster, obtained by crossing long and short staple varieties ; and Durango by acclimatization and selection of an imported stock from the State of Durango, Mexico, and which belongs to the Upland type. Some long-stapled early cottons had been obtained and gave good results when the weather was favourable to them, but Durango showed greater power of adaptation and gave good yields where other varieties had failed. The Durango plant had an erect bearing; it is early and bears heavily ; its bolls are large and they open well ; its foliage is light and open. In the Imperial Valley in California, Durango was tested in experimental plantings in comparison with Columbia, Foster, Allen and Egyptian, and proved so much superior to all its competitors that the local cotton-growing community is making an organized effort to place the valley exclusively on a Durango basis.—MONTHLY BULLETIN.

RAW COTTON CONSIGNED TO THE UNITED KINGDOM.

The following statement of Raw Cotton consigned to the United Kingdom from each British Possession (except India) and from Portuguese East Africa during the years ending December 31st, 1909 to 1912, is compiled from figures supplied by the Statistical Office of the Custom House, London (in bales of 400 lbs):—

	1909	1910	1911	1912
Gold Coast	98	30	24	14
Southern Nigeria	12,179	6,336	5,085	9,721
Northern Nigeria	186	74	168	1,061
Total West Africa	12,463	6,440	5,277	10,796
British East Africa and Uganda	4,255	7,811	16,866	26,831
Nyasaland	2,069	2,832	5,020	6,800
Portuguese East Africa	185	23	153	3,036
Total East Africa	6,509	10,666	22,029	36,667
British West Indies	5,479	5,385	8,407	7,337
British Guiana	-	-	1	-
South Africa	17	5	67	342
Australia	-	28	17	13
New Zealand	34	360	52	34
Sundries	93	3	687	474
Total Sundries	144	396	831	863
Total Bales	24,595	22,887	36,544	55,663

THE WORLD'S COTTON CROP RETURNS.

(in thousands of bales).

Season	America	India	Egypt	Brazil, etc*	Total
1903-4	10,124	4,471	797	2,760	18,152
1904-5	13,555	4,061	843	2,172	20,633
1905-6	11,320	4,797	798	2,542	19,457
1906-7	13,550	5,197	926	2,803	22,476
1907-8	11,582	4,445	965	2,916	19,908
1908-9	13,829	4,779	910	2,885	22,403
1909-10	10,651	5,317	678	2,768	19,414
1910-11	12,132	4,587	984	3,036	20,739
1911-12	16,043	4,078	965	3,882	24,968

* Including all other countries.

COTTON AT ROMA.

Judging from a sample of Uplands cotton grown during the past season at Roma, which has been brought to this office, there can be no question but that the district is eminently suited for this valuable crop. We have certainly seldom seen so fine a sample for length of staple, fineness of quality and abundant lint. The seed was planted in the middle of October last, and the crop was gathered about the end of April, and during these six and a-half months the plants received no attention whatever. The weeds were higher than the cotton bushes, and the latter were only from 2 ft. to 3 ft. high, and loaded with pods. This was an experiment made by two young farmers in this district.—Queensland Agric. Journal.

A PROFITABLE FARM.

By R. R. KERR, DAIRY SUPERVISOR.

During a recent trip to Darnum, the farm of Mr. J. Gaul was visited. The farm contains 140 acres, together with about 100 acres rented, and consists of hilly ground and rich flats along the Moe River, and is well adapted for successful dairy farming.

The casual observer is at once struck with the signs of enthusiasm and prosperity that mark the farm of the successful dairyman, and his great faith in the industry. Much of the success on this farm is due to the hearty co-operation of Mr. Gaul's family, the work being proportioned amongst them. All the milk is converted into cheese for sale in the neighbouring towns and Melbourne. At present 72 cows are being milked, and yield 176 gallons a day, or an average of 2½ gallons per cow, which means, with cheese at 8*d.* a lb., a return of £2 10*s.* a month per cow. Last year 65 cows and heifers were milked, and made on an average 671 lb. of cheese, at 6*d.* a lb., and, after deducting expenses in cheese-making, left a return of £16 1*s.* 3*d.* per cow. £100 was made out of pig-raising, and 20 calves from the best cows were reared, the owner refusing £2 10*s.* a head for them.

Mr. Gaul is a firm believer in the necessity of having one of the true dairying breeds, and not the so-called dual purpose cow, thus preventing the elements of the beef-producing interest from creeping into his dairy herd. He is of opinion that one can well afford to give the good cow away when her milking days are over; the two or three pounds extra one receives for the beefy animal, when dry, in no way compensates for the increased production during lactation from the true dairy cow. The Ayrshire type predominates in the herd, pure Ayrshire bulls being used. Culling is systematically carried out.

Twenty-five acres of oats were grown for hay, and 25 acres of millet for summer feeding, this latter being mainly grazed by the cows, though portion was cut for hay. This was chaffed with oaten hay, and, a little bran being added, steamed and fed to the cows during the winter months,—Mr. Gaul saying, "Feed is half the breed." The above results go to prove what can be accomplished by a little intelligent effort on the part of an energetic man, and serve as an example to the dairy farmers in general.—Journal of Agriculture, Victoria.

PADDY.

CULTIVATION IN CEYLON DURING THE XIXTH CENTURY.

By E. ELLIOTT.

(*Continued from p. 326.*)

In Matara, in the Eastern Pattus (Wellaboda and Kandeboda) there was a very large mortality in the 'sixties, due to the long continued drought and the consequent short supply of food. This naturally led to their being given an early preference for irrigation works. The effect on the population has been most satisfactory, the increase in the 30 years (1871-1901) being 50 per cent. as against 36 per cent. in the rest of the district where the climatic conditions are more favourable. This abnormal advance is equivalent to the super-addition of 6,300 individuals to the tax-paying community to be credited to irrigation. Not having the details by Pattus of the recent Census, I cannot continue the comparison up to date.

The super-addition in each district due to irrigation, over and above the normal rate which would have prevailed in its absence, as worked out in the foregoing paragraphs, is as follows :

District	...	in 1901	...	in 1911
Kurunegala	...	500	...	24,000
North-Central Province		11,000	...	14,500
Batticaloa	...	35,600	...	39,000
Trincomalee	...	4,400	...	5,700
Hambantota	...	33,700	...	35,500
Matara	...	6,300	...	6,300
Total	...	91,500	...	125,000

To ascertain the money value of the contributions of this abnormal addition to the tax-paying community, I have compiled from the annual reports the amounts collected as revenue in the three dirtricts, Batticaloa, Nuwerakalawiya and Hambantota and find the average is just over Rs. 2 per head, made up as follows : Under Road Ordinance 30 cents ; Excise (Arrack) 60 cents ; Stamps, fines and forfeitures, 45 cents ; Salt 27 cents ; to which must be added 40 cents collected through the Customs.*

The above figure (Rs. 2) is slightly under what Sir West Ridgeway estimated to be the contribution of the urban and rural inhabitant, viz : Rs. 2.42. Though he omitted the amounts yielded by the sale of stamps of all

* Note—In 1904 the Custom duties on Cotton Goods, Kerosine and other goods, *exclusive of rice*, was Rs. 5,805,616 or an average of Re. 1.60 per head of the entire population of the Island. I have taken the contributions under this head in the out-lying districts specified, at one-fourth of the island rates to be on the safe side, but it is probably too low.

descriptions and judicial fines and forfeitures, some of his items are too high for the three backward districts, and so I am content to rest my deductions on the lower rate I have worked out independently.

At the above rate of Rs. 2 per head the contribution to the general revenue of these 91,500 super-additional tax-payers, who would not have been in existence but for irrigation, amounted in 1901 to Rs. 183,000 per annum—a sum which is 3 per cent. on a capital outlay of 6 million rupees, as against, as already shown, an outstanding balance of about 5 million rupees—on the works in operation in 1906, including maintenance and upkeep.

Independent of further additions due to the Giant's Tank and other recent works, the above amount had by 1911 increased to Rs. 250,000, a 3 per cent. return on an expenditure of 8 million rupees.

With such assets as I have specified, I think it may be claimed that the irrigation policy in Ceylon to the end of the nineteenth century, judged on business principles, would have satisfied the requirements of a company working for a dividend which would have been a handsome one but for the abolition of a large source of return.

It must be remembered further that in these calculations I have included the whole sum spent, nearly 9 million rupees, inclusive of construction, maintenance and supervision, on the irrigation works in practical operation in 1906. But only under one-third of this amount has been expended on what would be classed in India as "reproductive work" and nearly all of this in Batticaloa and Matara, which have as I have already stated, repaid *directly* the entire outlay.

The balance has been spent practically on what would be considered in India "famine-relief" works, "as a struggle against nature and which seek to fortify the people against drought." It is further stated in the Indian Official List for the current year that "for the purpose of famine relief and insurance a million sterling is annually appropriated and when the direct famine relief is less the balance is used for protection works which are undertaken whether commercially profitable or not to protect areas that are liable to drought. "Further, the cost of minor works as well as the sum required for their maintenance and upkeep is met from the ordinary revenue."

THE NEW DEPARTURE

My object in treating of the outlay on Irrigation has been to ascertain the cost to the State of the additional production due to its co-operation ; and accordingly, I have hitherto restricted my enquiries to the expenditure on the older works, on what may be termed the *festina lente* principle which governed the policy of Government, until the beginning of the present century.

A fresh departure, prompted by a "period of financial prosperity unparalleled in the history of the Colony," was then inaugurated by Sir West Ridgeway, under which, in lieu of the moderate annual grant of Rs. 200,000, hitherto set apart for irrigation, a large lump sum was provided for concentrated action, to hasten the completion of the most important works, and which of course entailed a large addition to the staff of the newly-created Department.

In view of the slow rate at which irrigable land has been heretofore taken up in Ceylon and developed, it would in my opinion have been wiser to have made the increase more gradual; but the course adopted was certainly a high statesmanlike policy and similar to that followed in other countries such as Egypt, India, etc.

The inevitable delay in providing a return in the large expenditure has led to adverse criticisms, but as already recorded the very same objections were taken years ago to the Batticaloa works, which are now admittedly such a success, and the financial results, which I have already specified, show that notwithstanding the abolition of a large source of return in 1891, Government has been a considerable gainer on the whole.

A similar satisfactory end is, I feel assured, in store for the large outlay of the new century, and I would therefore deprecate adverse criticism at present, the more especially as the Colony can very well afford to be out of its money, and wait patiently for the success and return which past experiences have shown as bound to come in the long run.

It must be remembered further that most of these modern big works are in the North-Central and Northern Provinces; and are really "famine-relief measures" undertaken with a view of saving the remnant of population left in these once prosperous districts, and re-populating the Vanni. To secure this laudable object, it will be necessary to grant most liberal terms to settlers to take up the land, and I would specially deprecate the raising of the water rate beyond Rs. 2 per acre, on holdings purchased from Government on the usual terms.

The expenditure to the end of 1906, which may be considered as in suspense was Rs. 5,257,053, of which Rs. 1,300,000 was drawn from the loan raised for the purpose and the balance contributed from the general revenue.

On the 30th June, 1911, it had risen to Rs. 8,946,654.

The details are as follows:—

		To 1906	To 30.6.11.
On Construction of new works	...	Rs. 3,156,823	4,647,428
On Maintenance-therefor*	...	55,488	154,422
On Establishment	...	1,512,828	2,741,789
On Surveys, etc.	...	156,868	246,720
On Miscellaneous services	...	179,235	560,484
On Interest on loan	...	195,811	195,811
			Rs. 8, 546,654

In view of the large addition to the engineering staff which the above figures disclose, it is not surprising that numerous big works were speedily undertaken and "restorations of a monumental character" proposed. It was consequently a wise step on Sir Henry Blake's part, to direct that before any new works were begun, those already in hand should be completed, especially in regard to channels of distribution. Nor in view of the flourishing condition of the Island's finances was the decision to dispense with loan money to be deprecated, especially as it was expected the large works in hand would be completed by 1911.

But in making further provision, it must be borne in mind that the new system of administering "irrigation" renders inevitable a large outlay on establishment.

* Exclusive of upkeep of the old works say, Rs. 400,000.

As the above figures disclose it has risen to 30% on the gross expenditure and to 61% on the average outlay on construction and maintenance (Rs. 441,000) during 1907-10, as against 4½% in 1889-92 on similar expenditure, amounting to Rs. 390,000. It remains to be seen if the "game is worth the candle," but the great addition to the works prevents reversion to the old economical system, though some reduction may be found possible on the completion of the very large works under construction during recent years. But it will still be necessary to provide a considerable staff under the new system of supervision which now prevails, I believe, and provides for the presence of a responsible officer in each district, competent to attend to the upkeep of the works, but who is also available on the spot to regulate the wise and impartial distribution of the water. This duty has for many years been necessarily left to the local headmen, over whose action the Government Agents could do no more than exercise a general supervision.

MILK RECORDS.

We take the following table from the *Queensland Agricultural Journal* showing the milking records of cows for the month of March, 1913:—

Breed.	Date of Calving.	Total Milk.	Test.	Commercial Butter.
		Lb.	%	Lb.
Ayrshire	22 Jan. 1913	999	4·2	47·0
Holstein	2 Jan. ,,	1,080	4·8	45·73
,,	14 Feb. 1913	1,215	3·4	45·71
Shorthorn	5 Sep. 1912	634	3·8	43·40
Jersey	2 Aug. ,,	533	5·2	32·55
Ayrshire	17 Feb. 1913	855	3·4	32·17
,,	2 Feb. ,,	905	3·2	31·93
,,	12 Dec. 1912	659	4·3	31·78
,,	16 Feb. 1913	664	4·1	30·45
Holstein	22 Jan. ,,	926	2·8	30·43
Ayrshire	10 Jan. ,,	635	4·2	29·87
,,	5 Mar. ,,	718	3·7	29·55
,,	4 Dec. 1912	600	4·1	27·52
,,	15 Aug. ,,	484	4·8	26·17
Shorthorn	29 Oct. ,,	506	4·2	23·80
,,	5 Oct. ,,	418	5·0	23·59
,,	7 Dec. ,,	586	3·6	23·44
Jersey	3 Sept. ,,	369	5·4	23·43
Ayrshire	13 Dec. ,,	603	3·5	23·40
Jersey	13 Aug. ,,	401	5·1	23·10
Ayrshire	30 Nov. ,,	523	3·7	21·52

FRUIT.

APPLE GROWING IN TASMANIA.

A CEYLON PLANTER'S SUCCESS.

Mr. J. H. Barber, the head of the firm of Messrs. C. C. Barber & Co., Cocoa Planters and Manufacturers, Ukuwela, Ceylon, has started apple growing at St. Helen's, Tasmania, where he has purchased a large block of land and established an orchard, which, as the following report from Mr. L. A. Evans, Secretary of the Agricultural and Stock Department, goes to show, has proved a conspicuous success.

Mr. Barber was among the foremost of tea planters in the 'eighties when his Blackstone tea fetched record prices, and after establishing a sound business in Cocoa he settled down in the genial climate of Tasmania which would appear to be the very place for the retiring Ceylon Planter who has still some energy and enterprise left in him to supplement his income and at the same time indulge in a hobby such as apple growing :—

"The Cleopatras you forwarded have been exhibited for the last few days in Messrs. Taylor and Sharp's window.

"The Director of Agriculture, Mr. Benson, says they are the best of the kind he has ever seen.

"Mr. Ashbolt of Messrs. H. Jones & Co., thinks their colour is due to their being grown in a warmer climate than down south: he is of opinion that the colour would help their sale considerably. To my mind it is a striking example of the superior climatic conditions you enjoy and no doubt some day St. Helen's fruit will set the market value of Tasmania apples when produced up to your sample.

"The verdict of Mr. Osborne the Government fruit expert was that the fruit is as near perfection in colour as can be. This he considers to be due to the tree being grown on granitic soil and the apples maturing on the trees in full sunlight. The firm texture of the flesh would make the keeping qualities much superior to apples grown on any other class of soil. They could be shipped up to the end of April and should reach London in perfect condition, bringing any price you like.

"Mr. Osborne is naturally very gratified and sends you hearty greetings."

We would like to add our congratulations to Mr. Barber on the success he has been able to achieve.

WORLD'S PRODUCTION OF ORANGES AND LEMONS.

According to briefs and testimony presented before the Ways and Means Committee of the United States House of Representatives in its hearings on the revision of the tariff schedules, the principal orange-producing countries of the world are the United States, Spain, Italy, Palestine, Japan, Porto Rico,

and Cuba. The American orange industry is located in California, Florida, Louisiana, Texas, and Arizona and the total annual production is estimated at 2,000,000 boxes. About three-fourths of the American production comes from California, the number of boxes shipped in the 1911-12 season being 13,745,952 and in 1910-11, 15,695,450. The heavy freeze some months ago will reduce the 1912-13 yield much more than 50 per cent.; it is not yet possible to estimate the full damage to the crop. The total acreage runs about 110,000. The Florida production has previously run from 3,500,000 4,000,000 boxes annually, produced on an estimated acreage of 59,000, but the crop of the present season is expected to amount to 6,000,000 boxes or more, and the output of future years will doubtless average that much or more. The number of pounds of oranges shipped in 1911 from the principal foreign producing sections is given as follows: Spain, 859,725,553; Italy, 282,945,860; Jaffa (Palestine), 68,890,130; Japan, 14,158,559; Porto Rico, 25,076,880; Cuba, 3,609,817. California has furnished about 40 per cent. of the total orange supply of the world. The only sections of the world producing lemons in commercial quantities are southern California and southern Italy, especially Sicily. The acreage in lemon trees in California in 1912 was 31,478, and the production is given as about 2,000,000 boxes as compared with American importations of 1,812,000 boxes. In Italy about 350,000,000 lb. of lemons are produced annually. Boxes of lemons as received in New York from Italy run from 68 lb. to 78 lb. per box.—Grocers' Journal.

THE OBJECTS OF PRUNING.

One of the first things for the beginner to undertake as he approaches the practice for pruning trees and vines is to form some conception of the purposes to be served. Imitation is not foundation of intelligent pruning, though it yields many valuable suggestions. Satisfactory work rests upon a correct understanding of the reasons for each act, and to the attainment of this all study, observation, and experience should tend. Possessing this, one can proceed capably, modifying method to meet condition, and producing desirable results. Receive all suggestions and then go quietly to the tree, and study your problem in its shade. The tree is the best revelator of its needs. Some of our best pruners are men who were untrained to horticulture before they entered upon their orchard work. Reading, discussion, and systematic instruction, are all valuable. They save much time and many errors; but recourse to the tree affords the sovereign test of attainment. These may be counted among the practical purposes to be attained by pruning: (a) convenience of the grower; (b) health and strength of the tree; (c) regulation of heat and light; (d) attainment of strong bearing wood; (e) attainment of size in fruit; and (f) promotion of regular bearing.

On examining the tree, it will be found to be composed above ground of a trunk from which the main branches spring, which, in their turn, produce the laterals, on which the shoots and spurs, which bear the fruit, are to be found. Taking these points into consideration, we can hardly fail to secure rays of light upon the subject of pruning which seems dark to so many.

CONVENIENCE.

Trees which branch near the ground are most quickly and cheaply handled in all the operations of pruning, spraying, fruit thinning, and picking. Low trees, with obliquely rising branches, are more easily cultivated than any form with horizontal branches unless the head is carried so high that the teams pass easily under the tree. To do this, sacrifice all the other conveniences and economies which actually determine profit, and is really out of the question from a commercial point of view.

HEALTH AND STRENGTH.

It is imperative in most parts of this State that the sunshine be not allowed to touch the bark during the heat of the day. This protection is secured even for young trees by low branching. The low tree, with properly spaced branches, attains superior strength by virtue of thick, strongly-knit short growth between branches, and by its strong, stiff, obliquely-rising, growth, sustains weight which brings horizontal branches to the ground, and thus even high-headed trees are liable to continually increasing interference with cultivation, and the desperate grower has to raise the head of his tree higher in the air, and further above the profit line, while at the same time he renders it more liable to sunburn, to bark-binding, and to unthrift, by forcing the sap to flow an unnecessary distance, and through wood and bark which impede its movement. Besides, a low tree escapes stress by strong winds which a high tree invites, and at the same time is less able to withstand. Pruning for health and strength of the tree also includes the removal of unthrifty or diseased parts, which are not only an encumbrance to the tree, but may communicate to the other parts the causes of their ill-condition.

HEAT AND LIGHT

The maintenance of strong-bearing wood in the lower part of the tree is conditioned upon the proper pruning of the top of the tree. How far the upper levels or the shade layer of the tree can be safely opened depends upon the local climate in each fruit region. The rule must be : the higher the summer heat, the denser the tree ; the lower the heat, the thinner the tree ; but everywhere the proper condition of openness must be constantly in view in pruning. Not alone must this be done to maintain thrifty growth below, but it is also essential to the best growth and ripening of the fruit in the lower and interior parts of the tree. Fruit inferior in size, colour and quality results in part from lack of pruning to regulate the admission of light and heat—sometimes one, sometimes both—to the shaded portion of the tree.

BEARING WOOD

Good fruit develops on good bearing wood, and good bearing wood is the product of proper degrees of light and heat, as has just been urged ; but bearing wood in the case of some fruits is new wood, and the reduction of old wood for the purpose of forcing the growth of new wood must be constantly in mind. Renewal is more or less a consideration with all trees, and especially the securing of strong new wood. This is a point upon which close study of the bearing tree will yield most satisfactory suggestions.

SIZE OF FRUIT

The size of fruit, providing the tree is healthy and vigorous, depends upon the character and amount of bearing wood which the tree is allowed to carry. Removal of part of the fruit burden is done by thinning after it is

well set ; but this labour should always be minimised by antecedent pruning, which adjusts the retention of bearing wood, according to the vigour, size, and bearing habit of the tree. Thinning out of bearing shoots and spurs, when either are clearly seen to be in excess, should be the constant study of the pruner.

REGULAR BEARING

This point is largely involved in the preceding, and affords an additional incentive. Regulating the amount of fruit borne in one year involves the profit of two years, because a tree cannot produce an excessive amount of good fruit and perfect fruit buds for the following year. It may generally make buds which will bloom, but not always that. If it does make the bloom, it is no guarantee that the bloom will be strong and effective for bearing. Consequently, pruning for reasonable amount of bearing should always be borne in view, and should be practised at the close of the year of non-bearing with particular diligence, if the alternate year bearing habit is to be broken up.

While there are many who neglect to follow any system of pruning there are others, again, who, with the very best intentions, carry this important operation to excess by continuing to prune too heavily for, at any rate, a few years, certain kinds of trees after they have reached the age when they should begin to carry fruit. In making up our minds to follow any system, we should never lose sight of the commercial side of the business ; and any system which encourages excessive growth rather than fruit-buds and spurs, and prevents the tree from fruiting, should be avoided. The system to follow is that which will aid the tree in producing annually the greatest quantity of highly-coloured marketable fruit, and which, at the same time, involves the least training and pruning during either summer or winter, rather than one which entails much labour after once the tree has attained the bearing age.

The growing and pruning of trees is no longer a hobby with most of our fruit growers, but a commercial undertaking, and the grower should not go to the expense of doing more pruning during summer or winter than is absolutely essential for the purpose of properly spacing the limbs, and preserving a reasonable amount of bearing wood.—Queensland Agric. Jour.

BANANA MANURING EXPERIMENTS.

By J. C. BRUNNIH.

The quantities of artificial fertilisers, applied on some of our experimental plots, can be well considered as a world's record, as in some instances nearly 2 tons of artificial fertilisers are applied yearly, and the cost of the manure, 2(KPN), applied twice a year, amounts to about £25 per acre, and in the cases where lime was applied in addition to £29 per acre.

Our standard manure for bananas, KPN, is made up approximately from

3 cwt. of potassium sulphate,
2½ cwt. of dried blood, or nitrate of lime, and
4 cwt. of superphosphate, per acre.

This dressing is applied twice a year, and costs, including carriage to the mountain, about 10*d.* per stool.

The average yield of the experimental plots with the application (KPN), taking the average for three years from eight experimental plots, was 345 bunches, with 3,035 dozen of bananas per acre per annum, at a value of, say, £38 per acre (at 3*d.* per dozen), the artificial fertiliser costing about £12 10*s.* annually.

In the experiments 2 (KPN), in which the double amount of the standard was used, we obtained an average yield of 457 bunches, with 4,330 dozen, of a value of £54 per acre. This yield gives a slightly increased net profit over the yield from the plots manured with the standard amount only, but the promise for the future yields, as based on the results of the second series already obtained, should indicate the justification for using the double amounts of fertiliser on soils similar to the soil of the experimental plots.

In looking over the table of results, we find that the yield for 1912 (to December only) in Mr. Guy's experiment No. 9 (2 KPNA) was the highest of the series, with 21 dozen bananas per stool, at a cost of 1*s.* 8*d.* for manures, whereas the unmanured plot (No. 4) yielded practically nothing.

In the second series we find experiment No. 12, 2 (KPNN), giving the record yield of 30 dozen per stool, against the yield of the unmanured plot (No. 15) with only 11 dozen (this plot, however, was not entirely unmanured, as it was manured at the time of sowing the green manure crop, which then was ploughed under), and yielding in two seasons since planting actually 42 dozen per stool.

When taking the yield for three years we find experiments 6 and 9 leading with a yield of 45 and 46½ dozen, against the total yield of only 1½ dozen from the unmanured plot (No. 4).

The increases of yields of Mr. Foot's plots, and more particularly in those of the second series, are not quite so high, and we find that the unmanured plot D gave a total yield of 15 dozen per stool in three years, and experiments B and F2 (KPN), gave yields of 46½ and 40½ dozen per stool.

In the second series we find experiment U yielding 26 dozen in the two seasons per stool, the same experiment on Mr. Guy's plot, No. 13, giving 34½ dozen. In this instance the plot, without salt, No. 12, yielded 42 dozen on Mr. Guy's plot, and only 23½ dozen on Mr. Foot's plot. The difference is hard to account for, but it is quite possible that the yield on Mr. Foot's second series plots will be much increased the coming season.

The addition of lime gave a slight increase only in the unmanured plots and in experiment 18, showing that the lime already supplied with the artificial fertilisers is sufficient for the plants. The results about the addition of salt are again not conclusive, as in some cases a slight increase is shown, in others again a decrease, in the yield. The variation in the yields with regard to the form of nitrogen applied as fertiliser is very slight, and not conclusive, but I have very little doubt that the best results would be obtained when the quick-acting nitrate of lime and the slow-acting organic dried blood are used alternately in the fertiliser mixtures. An occasional change in the artificial fertilisers is always beneficial to the crops.

When using such large amounts of artificial fertilisers, a waste of the humus in the soil must be particularly guarded against; every scrap of organic matter should be saved and returned to the soil, and, if necessary, green crops grown and applied as mulch.

I take here the opportunity to draw attention to an interesting series of experiments carried out by Mr. Reg. G. Bartlett, the head teacher of the State School on Buderim Mountain, in his school experimental plots, by giving an extract of his report to the Department of Public Instruction :—

"Result of Banana Manuring Experiments from 1st March, 1912, to 31st March, 1913:—

(Bananas planted in September, 1911.)

	No Manure.	Manure without Potash.	Complete Fertiliser (1)	Complete Fertiliser (2)
No. of stool ...	7	7	7 ...	22
No. of bunches ...	7	8	11	29
No. of dozen ...	46	63	108	282
Dozen per bunch ...	6·4	7·8	9·8	9·8
Cost of manure per stool	*nil*	6½*d.*	8½*d.*	1*s.*4*d.*
Cost of manure per acre	*nil*	£9/8/6/	£12/6/6	£23/4/0
Value of crop per acre, at 3*d.* per dozen	£28/11/9	£39/3/0	£67/2/3	£55/15/2

Complete fertiliser No. 1 consisted of—

4 lb. dried blood.
2 lb. sulphate of potash.
2½ lb. superphosphate.

Complete fertiliser No. 2 consisted of—

4 lb. nitrate of lime.
4 lb. sulphate of potash.
8 lb. superphosphate.

"As will be seen by the return, complete manure No. 1 has so far given the best result. The crop at present indicates that in the coming year No. 2 manure may show up more favourably."

The experiments of Mr. Bartlett clearly demonstrate that potash is the dominant manure to bananas, and that many banana growers who were in the habit of manuring their land with bonemeal or other incomplete manures only, must have largely wasted the money spent on these manures. They further show that even virgin land can be profitably manured, and there can be no doubt that land so treated could be kept under bananas very much longer, and, in fact, would never become so exhausted to be unsuitable for banana culture. Of course, it may be necessary to give a spell between replanting.—Queensland Agric. Journal.

POPULARITY OF BANANA FOOD PRODUCTS.

By O. W. BARRETT.

Chief, Division of Horticulture.

After a decade or more of partially successful experiments in the manufacture and popularization of banana products, a definite market is now assured, at least in Europe, and we may expect to hear of numerous factories being established throughout tropical America and, let us hope, even in the Philippines, within the next few years.

Jamaica in the West Indies has been the mother, so to speak, of this industry and it is in that island where nearly all of the really important factories for handling bananas are now to be found. In the March, 1912 number of The Philippine Agricultural Review attention was called to the appearance on the market of several varieties of banana products; it seems, however, that recently several additional companies have entered into the business in Jamaica. From the Daily Consular and Trade Reports we learn that at least six factories are now in operation and two other companies are contemplating the erection of large plants.

The following quotation taken from the above-mentioned publication indicates clearly the present status of the business; the processes in use in the various concerns are, of course, more or less private, though for that matter Philippine conditions would necessitate the working out of special methods for handling the material here:

The original factory, which has been operating about six years at Gayle, claims to have a secret process for making banana figs. A large factory at Montego Bay had its machinery made after its own designs in New York. Two other companies expect to patent their machines, which have been locally designed and manufactured. It is understood that the drying is done by hot air and that it takes 400 to 500 pounds of fruit to make 100 pounds of the figs. For a good many years experiments have been made in drying bananas, but it has been difficult to find a process for making a product that would keep well. Now that manufacturers are using a variety of machines and apparatus it is to be expected that the best process will soon be known. Although worms are never found in ripe bananas, the preserved fruit, if left exposed, attracts insects and soon becomes infested with small worms, as is the case also with other dried fruits.

The food products manufactured are fig bananas or banana figs, cooking bananas, banana chips, flour, and meal. All the factories dry or evaporate the bananas whole without the addition of sugar, and yet they are sweet and palatable, like pressed figs, which they also resemble in colour. At least one factory cuts the bananas into short pieces before drying or evaporating them, thus making a product that looks much like the dried figs of commerce. It seems that it would be well in order to make a distinction to call the bananas cut into pieces "banana figs" and those treated whole "fig bananas." What are known as "cooking bananas" are so thoroughly dried as to be hard, the

colour of these being almost white. Broken into pieces they form "banana chips," which not meeting with duties are imported to be ground into meal or flour in the country of consumption. In spite of the fact that the meal is said not to keep well, one Jamaica factory uses an American gristmill for grinding the chips. Another company has its own factory in London, to which it exports the chips, to be ground into flour and meal and made into other preparations for market. A small booklet is issued there to set forth the dietetic value of banana foods as attested by British and German food experts and others; and there is added a list of products on sale, with recipes for their use, etc. These banana food products have been awarded many prizes, diplomas, and certificates of merit.

It seems that all banana food products are wholesome and nutritious. The figs are delicious and are likely to be preferred to real figs by many persons. The fig bananas cut into small pieces may be used like raisins to impart an additional flavour to cakes and puddings. The chips, after being well pounded or ground in a coffee or other hand-mill, may be boiled and then used as an excellent breakfast food or for making delicious puddings. Gruel, porridge, and other preparations made from banana flour and meal, which are rich in easily soluble carbohydrates, are recommended for infants, invalids, and dyspeptics. The negro women of Jamaica use banana meal gruel as a substitute for milk for their infant children. The banana itself is one of the most wholesome and nutritious of fruits if eaten slowly when it is perfectly ripe (that is, just before it decays), but not when devoured only half ripe, as is often the case in the United States, which causes many persons to regard bananas as being difficult to digest.

It seems only necessary to take the value of banana food products known in order to create a large market for them. Already they are to a considerable extent popular in Germany and Great Britain, which have been taking the bulk of the exports of such products from Jamaica..... The Hawaiian islands and the Philippines also seem to offer inviting fields for the profitable manufacture and exportation of banana food products.

An interesting feature in the comparative progressiveness of Europe and America in the line of adopting new foods, etc., is brought out in the statement that a large United States order was recently refused by one of the Jamaica companies by reason that it was under contract for shipment to Europe of practically its entire output. It seems that the combined capacity of the Jamaica factories is only some three tons per day, but this will probably be considerably increased in the near future.

The writer remembers with pleasure testing both at Key West, Florida, and Washington, D. C., a series of samples of banana products made by a Central American firm; moreover, he made numerous experiments (extending even to table tests) at the Porto Rico Experiment Station in the line of flours, meals and coffees, from numerous varieties of bananas and plantains grown in that island; in Porto Rico, however, the only form of banana food in general use aside from the fresh fruits is a plantain flour from which a most wholesome gruel for invalids is prepared.

In short, then, we should remember that banana products can be very cheaply grown in the Philippines; that these foods may be very conveniently and safely stored, transported, and exported; that they are of very high nutritive value; and therefore that they cannot be overlooked in any study of the social economics of these Islands. In short, the banana as a crop not only helps out very materially the precarious old one-crop system but also provides a very interesting subject for study by the future manufacturers and merchants in the Orient. Phil: Agric: Review.

TORTURE OF ANIMALS.

Flaying Live Goats: Religious Brutalities.

We have received the following from the Animals' Friend Society.—

In a new illustrated pamphlet published by the *Animals' Friend Society*, York House, Portugal Street, London, attention is drawn to the Indian practice of flaying live goats. This barbarity is prevalent throughout Bengal and is done in order to obtain longer measurements for the market, so-called long necks commanding a higher price on account of the extra length. The dreadful process is carried out by beginning the flaying of the eyes and mouth of the living goat, and working down the neck, after which the throat is cut. In one of these cases, which came under the notice of the Hon'ble Mrs. Charlton, the flaying had been partially carried out, and the animal, though rescued from his tormentors, finally succumbed in misery to the agony it had endured.

BRANDING WITH RED HOT IRONS.

The practice of branding domestic animals for ornamental purposes and slitting the ears and nostrils of donkeys is prevalent in many parts of India. These cruel operations entail great pain and suffering, though they are erroneously supposed by the poorer classes of the population to convey some benefit to the animal. Bullocks with one side of the face almost burnt away are to be seen everywhere throughout the East and but little comment is aroused by the plight of these unfortunate creatures who toil yoked to a heavy ill-balanced cart.

MANUFACTURED MONSTERS.

In Delhi and elsewhere secret places exist where bullocks are turned into monsters for exhibition in religious processions. "I myself," says Mrs Charlton, "saw one of these poor man-made monsters at Hardwar, a sacred place in the Dun (United Provinces) and secured a photograph. It was being led about in charge of a fakir, who showed me with pride several legs which had been engrafted on its back; and the process must have been most painful." In performing this cruel operation more than one animal is killed in the greatest agony. Though it would be impossible to discover the various cellars and caves where these abominable cruelties take place, it is maintained that a single enactment rendering the exploitation of such animals illegal would cause the supply to cease automatically.

TOBACCO.

TOBACCO STEM BORER.

The Tobacco Stem Borer causes a great deal of loss every year in the tobacco nurseries, as every plant attacked is thereby rendered useless for planting out.

The stem borer is the larva of a small moth of the family *Tineidæ*.

LIFE HISTORY.

The present writer has not found the eggs of this pest, but apparently they are laid either at the apex of the stem or on the mid-ribs of leaves. When the caterpillar hatches out it eats its way down into the stem which swells as the result of this irritation. This swollen condition of the stem enables one to detect the presence of the pest. Very frequently the plant no longer stands upright but bends over. When the caterpillar is fully fed it cuts a hole to the outside, leaving it covered by a sort of parchment. It then turns to a pupa. After about ten days a small grey brown moth, rather like the clothes moth, emerges, leaving the plant by the hole previously cut by the larva.

These pests make their appearance towards the end of December. As soon as any infected plants are found they should be pulled up and either buried or burnt. If they are simply pulled up and left lying about the moths may be able to escape and are thus free to do more damage. In this Protectorate and in India the natives slit the side of the infected stem and remove the caterpillar. This is supposed to make the plant capable of further growth, but any plant which has first of all been attacked by the stem borer and then prodded with a knife is not likely to produce good leaves, and it is better to pull it up at once and burn it.—Nyasaland Govt. Gazette Supplement.

SIZE OF KEW PINEAPPLE.

A Kew pine weighing 16 lb. was received from Mr. D. H. Munasinghe Inquirer into Crimes, Matugama, who was awarded a prize for his fruits at the All-Ceylon Exhibition, 1912. It was a well ripened fruit. Mr. Macmillan mentions 20 lb. as the record for Henaratgoda. Mr. W. A. de Silva grew pines weighing 21 lb. on his Sirinewesa Estate, Waga, while a fruit from the late Mr. Supparamaniam's property at Pannipitiya turned the scale just under 24½ lb.

POULTRY.

THE UTILITY POULTRY CLUB'S TWELVE MONTHS' LAYING COMPETITION.

The competition has now been running for seven months, and the figures for the seventh period, which ended on April 29th, are available.

The position of the leading pens is as follows:—

Order.	Pen No.	Breed.	Total Eggs for seven months.	Total Money Value.
				£. s. d.
1	86	Buff Rock ...	676	3 17 2¾
2	60	White Wyandotte ...	711	3 15 11¼
3	32	,, ,, ...	666	3 8 7¼
4	45	,, ,, ...	638	3 5 9¼
5	24	Black Leghorn ...	608	3 3 11⅚
6	40	White Wyandotte ...	604	3 3 0¼
7	35	,, ,, ...	623	3 2 8¾
8	80	Buff Orpington ...	602	3 2 7¼

The highest score of the month was secured by the Silver-laced Wyandottes in Pen 62, which produced 163 eggs. A slight decrease in the total number of eggs laid during the month—10,684 as against 11,292 laid the previous month—is attributed to broodiness.—Board of Agric. Jour.

FECUNDITY IN FOWLS.

A remarkable paper, dealing with the inheritance of fecundity (laying capacity) in the domestic fowl, has recently been published by Dr. Raymond Pearl, of the Maine Experiment Station, states the *Board of Agric. Journal.*

The contribution in question has been briefly noticed in scientific and practical journals, but since the conclusions reached by Mr. Pearl have an important economic bearing, they merit a fuller exposition than has hitherto been accorded to them.

In the following pages an attempt will be made to divest the subject of the technicalities that its connection with Mendelian theory inevitably entails, and to present the results in a form more applicable to practical conditions. At the same time, it should be stated that the investigation is of supreme scientific interest, inasmuch as it is one of the few instances in which (if Mr. Pearl's results are confirmed for all breeds of fowls) the inheritance of animal characters of direct economic value has been proved to be governed by Mendelian laws.

The work under notice is the outcome of a series of investigations into the inheritance of fecundity which have occupied five years, and have been concerned with the egg-laying records of several thousands of individuals.

The work began on the lines familiar to all practical breeders of animals. It was assumed that by progressive selection of the best laying hens of one breed (in this case Barred Plymouth Rocks) and their progeny, a gradual improvement in fecundity would take place, and that, eventually, a strain would be established which would breed true to high egg production.

In a previous paper Mr. Pearl has shown that this method was entirely barren of result, and that progressive selection in the mass, based solely on the laying record of the hens employed, was unable *by itself* *to secure the desired object—that is to say, the establishment of a new strain with a high average egg production. Mr. Pearl's discovery, stated as briefly as possible, is that the *male* is the principal agent in transmitting fecundity, *and that selection of cocks must be practised, as well as selection of hens*, in building up the desired strain of high fecundity fowls.

It is necessary, at the outset, to have a clear idea as to what is meant by fecundity, and how it shall be measured. Mr. Pearl's conclusion is that the distinguishing differences in egg-production between good and bad laying hens occur in the winter period, October 1st to March 1st. In other words, he found (for the breeds with which he worked) that, on the average, there is little difference between one fowl and another in the number of eggs laid in the spring and summer, whereas the differences between strains (and individuals) in the number of eggs laid during the winter are very marked. Thus, the strain of Indian game with which he worked gave an average winter egg production of less than one-third of that given by a strain of Plymouth Rocks. For the purposes of his investigations, therefore, Mr. Pearl adopted the winter egg-production as the measure of fecundity, and it should be understood that in all subsequent references to fecundity the production for the winter period only is meant.

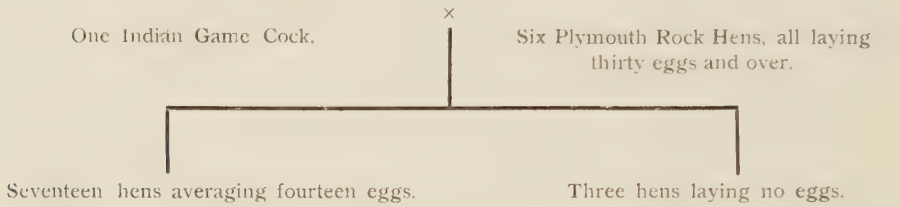
It was found that hens can be placed in three distinct classes: (a) those laying no eggs whatever during the winter period; (b) those laying under 30 eggs; and (c) those laying over 30 eggs. Avoiding all Mendelian phraseology, certain results obtained by Mr. Pearl may now be stated as facts, entirely independent of any theory which may be framed to account for them.

He found, then, that if he took hens of his third class (those laying 30 eggs and upwards during the winter period) and bred them to certain cocks, none of the daughters showed a laying capacity of over 30 eggs. In other words, hens of high productiveness were unable (when mated with certain cocks) to transmit their qualities to their daughters. On the other hand, he found that hens of the 30 and over class, if mated with certain other cocks, gave sometimes *all* highly productive daughters, and, sometimes, partly high producers and partly low producers. Again, he found that if he mated certain cocks with hens of zero, or low producing capacity, he got *all* the daughters

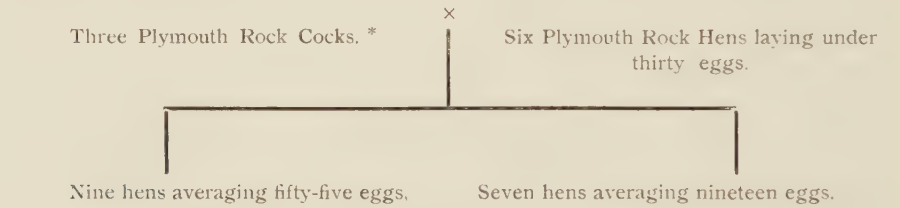
* This is to say, without selection of the cocks—such as *might* result from using the male offspring of the selected hens.

producing 30 eggs and over. As concrete illustrations of these statements the following figures may be given :—

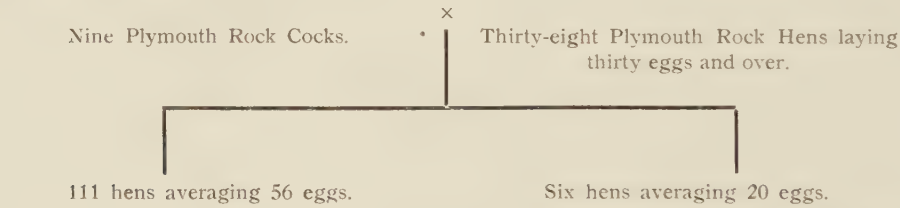
(A) To show that a highly productive hen does not transmit her fecundity to her daughters :



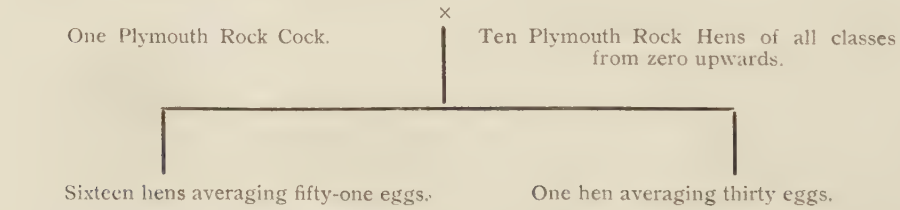
(B) To show that a hen of low fecundity may produce daughters of high fecundity :—



(C) To show that hens of high fecundity produce nearly all fecund daughters when properly mated :—



(D) To show that certain selected cocks will produce practically all fecund daughters, *however mated:*—



It should be noted that the same facts were observed when either Plymouth Rocks or Indian Game were mated *inter se*, and also in the first crosses of the two breeds, as well as in the descendants of the hybrids.

The Mendelian theory alluded to, if established, makes it possible to predict the number of birds which should fall into the various categories. The following figures show how close the fit is between theory and observation :—

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* From other tests it was known that these cocks were getting high-laying hens.

Table showing the observed and expected distributions of winter egg production of *all* progeny of *all* matings.

Classes.	Birds laying over thirty eggs.	Birds laying under thirty eggs.	Zero.
Observed ...	460	459	77
Expected ...	476	464	56

The only significant discrepancy is in the case of the zero birds. In regard to them it is explained that many of the birds that did not lay suffered from some physiological or mechanical defect, which was probably individual and not inherited.

It is due to Mr. Pearl to add that he does not claim that his results are necessarily true for all breeds or strains of poultry, and that he recognises the possibility that different schemes of inheritance may apply to other breeds with which he experimented—the Plymouth Rocks and the Indian Game—may differ in regard to the working of one of the "unit characters" which he has postulated.

The question that naturally suggests itself is: If the facts and theory outlined above are correct, will they assist the practical man in an endeavour to improve the fecundity of his stock? This question Mr. Pearl promises to answer in a future paper, but without undue intrusion into the domain of another, it is possible to indicate, briefly, how one would proceed under the guidance of the theory.

Clearly, the main desideratum is to produce the cock which invariably gets daughters of high fecundity; to do so, the high fecundity hen must be found by selection; she will transmit her desirable character through her sons, but only in certain cases will all these sons be of the highest quality. If all are of the highest quality (that is, invariably getting high fecundity daughters, however mated) then their father is the male wanted. But if, as is more likely, the sons differ, each must be tested by mating, with a view to ascertaining what his quality is. This testing should be done, preferably, *with zero hens*, for if the male is not of the highest class he will, when mated with such hens, get daughters of low fecundity. Such an outline would be the method of procedure: it would be necessary to push in-breeding as far as practicable, and in this respect to follow the procedure of the founders of the great cattle breeds. The system, too, would necessitate the trap-nesting of the hens and the keeping of careful records of all matings.

THE CLUCKING HEN.

The clucking hen is always fat—in fact, that she weighs a pound more than at other time, because she puts on flesh to prepare for the long siege of sitting. It has also been suggested that she will not lay any more eggs for perhaps two or three weeks. Now, I somewhat question whether the above

is true; and I wish our poultry friends would give their opinion in regard to the matter. My experience seems to have been that a clucking hen is generally a pretty good layer. If she is broken up promptly she will soon be laying again, and so on. I have two Rhode Island Reds in my Florida home that commenced to lay when the chicks were about three weeks old. One of them never sat at all. I gave her a lot of chicks from the incubator the very morning she began to cluck. She took excellent care of her chicks, and before they were quite three weeks old she would excuse (?) herself and go off and lay in a stolen nest. She did this for quite a spell, still taking excellent care of the chicks. This article I have mentioned says, "There is really no secret why a clucking hen is better food than any other sort;" but I must confess that I do not like the idea of killing a laying hen unless you have proved by trap nest or in some other way that she is a poor layer. If she wants to sit after she has laid, say, fifteen or twenty eggs, we consider it is nothing particularly against her.—SAN FRANCISCO EXAMINER.

RAINFALL FOR MAY, JUNE AND JULY.

Place.	May.		June.		July.	
	1913 in.	1912 in.	1913 in.	1912 in.	1913 in.	1912 in.
Colombo ...	7·12	12·30	5·27	12·70	6·64	2·50
Kandy ...	4·04	2·91	6·26	9·60	5·76	10·75
Galle ...	10·74	16·26	4·22	16·51	7·64	4·75
Jaffna ...	·30	1·74	·06	1·26	2·08	·35
Anuradhapura ...	1·31	1·60	·45	3·56	2·34	·17
Kurunegala ...	8·46	9·48	4·82	14·18	2·63	5·50
Batticaloa ...	·92	1·67	·08	1·60	·65	·34
Badulla ...	2·50	9·10	·49	·20	·82	1·97
Ratnapura ...	20·48	21·09	6·05	22·82	7·70	15·79
Nuwara Eliya ...	5·39	5·21	7·07	10·52	9·34	7·96

DRY-FARMING.

Dr. William MacDonald, of the Union Department of Agriculture, one of the first authorities on Dry Farming contributes an article on the subject in the June issue of The Nineteenth Century under the heading "Rainless Wheat" from which we extract the following :—

The last romance of agriculture, the most daring of its many triumphs, is the Conquest of the Desert. Pictured in the winsome song of the Psalmist, the sonorous prose of the Hebrew prophet, and visioned in the pages of a modern seer, it has remained for the latest science, the deep-set shore, and the diligent harrow to complete the ancient prophecy and to produce a harvest of corn from a rainless land.

To understand what has been accomplished, it will be necessary to sketch the rise and progress of this new branch of agricultural science known as dry-farming. In the study of dry-farming we are led at the outset to ask what is the real meaning of the term "Desert." The dictionary defines it as a "barren tract incapable of supporting population, as the vast sand plains of Asia and Africa which are destitute of moisture and vegetation." Such a definition is apt to mislead us, for what is now a desert region may be transformed in a few years into a country of fertile fields capable of sustaining a large population. The most striking illustration of this fact is to be found in America. Spread out an old map of the United States of less than fifty years ago, and you will see that vast region marked "The great American Desert" stretching from the Missouri to the Rockies. What has happened? In the space of a single generation, an army of settlers has invaded this country, and six trans-continental railroads bring the comforts of civilisation to the farmer's door. Next, turning to the British Empire, we note that desert region of Australia so quaintly called the "Never-Never-Country," on the fringe of which farmers even now are settling. And, coming to South Africa, we mark out the Kalahari Desert, or, as it is termed in the native tongue, the "Great Thirst Land." Even there the white flag of the surveyor can be seen staking out a fifty-thousand-acre farm from the silt-laden waters of the Orange River to the restless crest of a barren, blood-red sand dune. The lesson of all this is plain. In our dry and desert lands we possess a priceless heritage ; and if there are any who still think that there are no more good farms to be had in our oversea Dominions you may remind them of that saying of Emerson : "The last lands are the best lands. It needs science and great numbers to cultivate the best lands and in the best manner."

WHAT IS DRY-FARMING?

At a recent lecture on "South Africa," delivered by the writer before the Royal Colonial Institute, the question was asked : "What is dry-farming?" Dry-farming may be defined as the conservation of soil-moisture during long periods of dry weather by means of tillage, together with the growth of drought-resistant plants. Dry-farming differs from ordinary farming in that the chief object of the dry-farmer is to prepare his lands to receive and retain as much rain as possible. This is accomplished by the use of moisture-saving fallows.

"Dry-farming" is a new term which was first used a few years ago in Western America. In Utah and some other parts of the United States it is called "arid-farming." Still another term is "scientific soil culture." For the sake of uniformity, all experiment stations, agricultural societies and the rural Press would do well to speak of dry-farming and dry-land agriculture.

It is sometimes said that dry-farming is a new agricultural practice. But it is not so. Even in America the farmers of Utah have been raising crops on their dry lands with a rainfall of less than fifteen inches for over half a century. More than that, dry-farming has been practised since the dawn of civilisation in Mesopotamia, in Egypt, and in North-western India. And, as Professor Hilgard, of California, remarked to the writer,* "the great depth of soil in arid regions as compared with that of humid climates undoubtedly explains how the ancient agriculturists could remain in the same country for thousands of years without having any knowledge of scientific agriculture." Most farmers are aware of the fact that the roots of plants go far deeper in dry regions than in damp climates. Now, if the roots of plants can penetrate to great depths, so surely must both moisture and air. It would thus seem as if an All-wise Providence had amply compensated the agriculturist of the arid regions by giving him in many parts of the globe great depth of soil combined with an almost inexhaustible fertility. Such, at least, is the lesson of history.

Summing up, we may say that desert regions are specially adapted to dry-farming, because as a general rule desert lands are deep lands, in which the scanty rainfall can be stored for a long period; and though arid soils are usually poor in humus, they are much richer in nitrogen than the soils of humid regions. It has been shown that the nitrogen-fixing germs are actively present in large numbers in dry soils. Finally, desert lands are usually free from malaria, and are thus well suited to colonisation.

THE PRINCIPLES OF DRY-FARMING.

As the writer has elsewhere pointed out† the English agriculturist Jethro Tull is entitled to be called the "Founder of the Principles of Dry-farming." It is true that Tull saw as through "a glass darkly." To-day we see more clearly. But the principles which we have adopted are merely the amplification, nothing more, of those fundamental methods of tillage so plainly set forth, one-hundred and eighty-two years ago, by the genius of Jethro Tull.

In his agricultural classic (1731) entitled *The New Horse-Hoeing Husbandry*, or *An Essay on the Principles of Tillage and Vegetation*, the inventor of the corn drill wrote: "For the finer land is made by tillage the richer will it become and the more plants will it maintain." This axiom has received ample confirmation on the arid lands of the United States and the British Empire, where the deep ploughing of the virgin prairie and the thorough pulverisation of the stubborn veldt sets free æons of fertility.

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*See *Dry Farming: Its Principles and Practice*, by William Macdonald p. 10, London; T. Werner Laurie.

†*Bulletin No. 103*, Union of Agriculture.

It was Tull who first enunciated the three great principles of the new farming: (1) Drilling; (2) reduction of seed; (3) absence of weed. And he left a happy epigram which at least is true for the sunlit lands oversea: "Tillage is manure."

The principles which we have adopted in our experiments on the Government Dry-Land Station at Lichtenburg, in the Transvaal, and which are now being extended to the other dry land stations throughout the Union of South Africa, are eight in number, namely: (1) Deep ploughing; (2) pure seed; (3) thin seeding; (4) drilling; (4) frequent harrowing; (6) weedless lands; (7) few varieties; (8) moisture-saving fallows.

MOISTURE-FALLOWS AND THE SOIL-MULCH.

We believe that our success has been due mainly to the use of moisture-saving fallows, in which the rain is stored up in the soil for the use of subsequent crops. The supreme need of South African agriculture is not fertility but moisture. Consequently, all our cultivation is directed to establishing a moisture-saving fallow which may be maintained for periods of three months, six months, or one year. Such a fallow is deeply ploughed in the first place, and then kept constantly tilled to prevent the formation of a soil-crust which would permit the moisture to evaporate. This treatment results in four things: (a) Storage of rainfall; (b) destruction of weeds which are moisture-robbers; (c) admission of sunshine and air; (d) encouragement of beneficial soil-germs.

Messrs. Russell and Hutchinson, of Rothamsted, recently demonstrated that intense sunlight destroys those harmful soil organisms which prey on the plant-food making bacteria. The illuminating researches of these scientists enable us more readily to understand the spontaneous and marvellous fertility of the lands of South Africa which are bathed in sunshine.

The germ life of arid lands is a subject worthy of the attention of the Universities of the Empire.

The well-known term soil-mulch is deserving of a brief notice. It may be defined as "any material which is spread upon the soil to shade the surface from the sun and to break the connexion between the water-bearing sub-soil and the exposed surface." Examples of mulching are familiar to everyone. Turn over a board or stone lying on the ground, and you will find that the soil beneath is moister than the ground around it, since the pores of the earth, or capillary channels, have been closed, and the current of moisture passing upward to the surface has been stopped. In the garden, leaves, straw, and manure are commonly used. But the most practical mulch is made of loose, dry soil. This is done by frequently stirring the surface of the ploughed lands with a harrow or cultivator. The soil-mulch is also termed the soil-blanket.

Now the question arises: "How deep should the soil-blanket be?" The reply is: From two to six inches, depending on the state of the weather, the soil, and the crop. In orchard cultivation, during a severe drought, the soil-blanket is often made six inches deep, or even more. But for cereals the soil-blanket should seldom be thicker than two to three inches, as they are surface feeders. When sowing, the seed must be drilled into the moist seed-bed below the dry blanket otherwise it may fail to germinate.

SUMMARY OF RESULTS.

It is doubtful if, since the time of Tull, any soil has had a severer test of his profound but forgotten principles than the dry lands of Lichtenburg in the Western Transvaal. Let us summarise what has been accomplished there.

We have shown :

(1) That by our system of tillage we are able to keep the soil seed-bed moist for a whole year. This means that, so far as moisture is concerned, we can plant a crop at any season—a most important matter in South Africa. This result has been attained by the use of moisture-saving fallows, deeply ploughed, constantly harrowed, and kept covered with a dry-soil blanket which checks evaporation.

(2) That it is possible to grow dry land winter wheat and to harvest it before the season of rust.

(3) That drilling, as might be expected, is far better than broad-casting, saves seed, places the grain in the moist seed-bed, and gives a more even growth.

(4) That thin seeding, for wheat 30 to 40 pounds per acre, gives larger returns than more lavish sowing. This is due to the fact that each individual plant has more moisture sunlight, and food if given ample space.

(5) That the durum wheats have given the best results. They are the wheats which have extended the wheat-belt into the most arid regions of Western America.

(6) That the durum wheat—*Apulia*—has been grown under our dry-farming system without a drop of rain falling upon it from seed-time until harvest, which proves the efficacy of the moisture-saving fallow, and is a record in modern agriculture.

A GERMAN TESTIMONY.

A short time ago a fair-headed, blue-eyed Viking was sent from Berlin to Windhuk to grow two blades of grass where but one grew before, in the person of Mr. Walter Richter, the Agricultural Adviser to German South-west Africa. He spent several months in British South Africa investigating our soils and crops with the skill, the patience, and the industry for which his race is so justly renowned. To our question : "What do you consider the most instructive part of your tour ?" Mr. Richter replied without hesitation : "The Dryland Experiment Station at Lichtenburg. There I saw durum wheat being harvested which not only had been grown on a poor shallow soil, but actually never had a drop of rain upon it from seed-time until harvest. There, also, I saw *dry land* which is never dry the whole year round. I go back to German South-west Africa filled with a new hope, for now I am convinced that dry-farming is destined to revolutionise our agricultural industry. Truly, as the motto of your Congress puts it : "The destiny of South Africa is on the dry lands."

Every great movement is indissolubly linked up with the personality of a few earnest workers. So it is with dry-farming in South Africa. The signal success which we have achieved is due in large measure to Captain Heinrich du Toit, a brave Boer officer of the former Staats Artillerie who bore a charmed life, as shown by marks of twenty-two bullets. Captain du Toit returned to the peaceful life of a Cape Farmer. When the Government dry-land station was established he was appointed manager—a post which he still holds. He has since become the tireless missionary of the new agriculture amongst the Dutch and the English settlers on the dry lands of the Union.

MOISTURE BANK AND HUMUS BANK.

Hardly a season passes but we hear of crops that have failed because of lack of rain, and this complaint is not confined to any particular dominion, but is more or less common to all parts of the Empire. Search the pages of the rural magazines, consult the columns of the daily Press, and, sooner or later, your eye will light on that sombre line : "The crop has failed this year owing to drought." And the amazing thing is that no remedy is ever suggested, no preventive is ever proposed. Decade after decade, year in and year out, drought finds the farmer unprepared, watching sadly his withering crop in sun-scorched waterless soil.

The Alpha and Omega in the fight against drought is the moisture-saving fallow. Without it all effort is useless. With it all soil-drought disappears. Suppose we start with the bare moisture-saving fallow and we conserve six inches of rain out of a 12-inch annual rainfall. We hold the fallow for a year and then sow our wheat in a moist seed-bed. The second season another twelve inches may fall in the field, of which, say, six inches are utilised by the plants, and so, at the end of the second year, instead of one or two possible failures, we reap a 30-bushel* (12-inch rainfall) crop of wheat. The establishment of a moisture savings bank to pay cash on demand is the fundamental principle in dealing successfully with recurrent seasonal droughts. This practice is strongly advocated by the foremost Australian authority on dry-farming, Sutton of New South Wales, who writes :—

> In dry districts a proper system of fallowing is therefore an essential of success, and the general adoption of a proper system in our wheat districts is a factor which will do more than any other to remove wheat-growing from the area of speculation and place it on a sound and solid basis. With a proper system in practice, the rainfall of the previous, or a portion of the previous year, can be stored, conserved, and utilised for a subsequent crop.

And he closed an instructive address to an assemblage of farmers with these words : "Go back home and fallow till harvest time, and when the harvest is over, start to work the fallow and keep at it until seed-time."

It may be said that the practice of growing crops on only half of the arable land and maintaining the other half in clean fallows means a good deal of extra labour. That is so, but it also means a certain crop in seasons of drought. It may be said that the continuous cultivation of the moisture-saving fallows will eventually burn out the vegetable matter in the soil. It may be so; but the remedy is at hand. On worn-out fallows you can always grow green legumes, fill the soil with nitrogen, and so gradually establish a humus bank. These two saving banks—the Moisture Bank and the Humus Bank—will secure the farmer against the severest drought and make possible a permanent fertility on the dry-lands of South Africa.

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* Widtsoe calculates the crop-producing power of rainfall as follows :

One acre inch of water will produce 2½ bushels of wheat.
Ten acres inches of water will produce 25 bushels of wheat.
Twenty acres inches of water will produce 50 bushels of wheat.

THE YEAR OF DROUGHT.

The prospect of a year of drought is the favourite topic of conversation for those lukewarm Laodiceans who, by idle criticism, vainly try to check the progress of dry-farming. Drought to the intelligent dry-farmer is no more than a passing storm to the skilful mariner at sea. Before us lie two authentic records of farms where the year of drought brings no dismay. These records are taken from the admirable work on dry-farming of the most eminent American authority, Dr John H. Widtsoe of Utah. The first farm belongs to Senator Barnes of Utah, and is situated in the Salt Lake Valley. The climate is semi-arid, the summers are dry and the evaporation large. Over a period of nineteen years crop and rainfall records have been most carefully kept There has been only one crop failure, and that was the first, when the land was not yet properly tilled. The heaviest crop of wheat, 29·8 bushels, was harvested in the year 1902, when next to the lowest rainfall occurred, which varied from 10·33 inches to 18·36 inches. Moisture-saving fallows followed every crop.

A second and equally instructive record is furnished by the Government Experimental Farm at Indian Head in Saskatchewan, Canada. Here also reliable records have been kept for the same period—viz., nineteen years. Not a single crop failure is recorded. The highest yield was forty-nine bushels to the acre, the lowest seventeen. During this period the rainfall varied from 3·9 to 20·22 inches (snowfall not included—varying from 1·3 inches to 2·3 inches of water). Here also moisture-saving fallows followed every crop.

These experiments clearly show that the year of drought need not be feared when the principles of dry-farming are properly carried out. In the conservation of soil moisture lies the ultimate conquest of drought. And in place of the barren desert, abandoned homes, and dying cattle, we can now paint a new and glowing picture. There, under a serene and cloudless sky, lies a panorama of green and chocolate-brown—mile after mile the growing wheat and the deep-stirred, water-holding fallow. No rain may fall for many a day, but the husbandman is untroubled. For he knows that his seed has fallen upon good ground, and that, from far below, those life-streams are flowing ever upward which will carry his hundredfold corn white unto the harvest.

CASTOR PLANT IN MANNAR.

The Editor of the Tropical Agriculturist

Dear Sir,

I beg to forward this day under separate cover sample seeds of the above plant which is grown to some extent as a "Chenai" crop in Mannar District. The method of taking oil out of the seeds in Mannar District is as follows :

The seeds as picked from the plant are dried in the sun. Then they are boiled in water and afterwards well pounded in a mortar. Again they are dissolved in water in a pot and boiled. As it is boiled the liquid matter floating on the top is collected into a pot and heated again till the water evaporates. That which remains is oil which is used in Mannar for lighting.

—S. Chelliah, A. I.

SOILS AND MANURES.

RECENT INVESTIGATIONS AT ROTHAMSTED.

[BY Dr. E. J. RUSSELL.]

DETAILS OF INVESTIGATIONS.

Considerable attention has been paid to the conditions under which the production of plant food, and especially of ammonia and nitrates, goes on. It has been shown that the process is mainly the work of bacteria, but that in normal soils the bacteria are not working at their maximum efficiency. A factor has been discovered limiting the numbers of bacteria and therefore the amount of decomposition they effect.

All the available evidence goes to show that this factor is biological. It is capable of growth, is put out of action by heat or antiseptics and can only be set up again by infection from outside: it does not, however, appear to consist of bacteria, and is provisionally identified with the protozoa, of which numbers have been found in all the soils examined. Partially sterilised soils from which the factor has been extinguished are found to contain large numbers of bacteria than untreated soils and to accumulate ammonia and nitrates at a greater rate: they are, as might be expected, more productive. Methods are being worked out for applying this kind of soil treatment on the large scale, but instead of setting up a large number of field plots to discover some cheap and convenient process, the simpler alternative is adopted of inducing horticulturists who go in for intensive culture to adopt some of the methods known to work. This has proved very satisfactory and has led to a considerable cheapening of the method, besides revealing some of the difficulties attendant on its application on the large scale.

PLANT WORK.

We now pass on to the plant work. The amount of growth a plant makes in a given soil is known to depend on the amount of food supplied and this relationship forms the basis of the connection between the plant nutrition work and the soil work. But a hypothesis is current, and is backed by sufficient circumstantial evidence to make it worthy of consideration, that inorganic plant poisons act as stimulants to growth if supplied in sufficiently small quantities. If this hypothesis were well founded it would introduce a wholly new set of factors into plant nutrition relationships, and would, in addition, form a basis for important practical developments. Very careful water cultures have therefore been made by Dr. Winifred E. Brenchley to test this hypothesis as completely as possible. The compounds tested have been copper sulphate, manganese sulphate, zinc sulphate, sodium arsenite

arsenious acid and boric acid, and a wide range of concentrations has been adopted. Numerous plants have been tried, but on the whole barley and peas have proved most satisfactory. Copper sulphate was invariably toxic even in such high dilutions as 1 part of salt to ten million of water. The effect varied, however, with the plant and was somewhat masked in presence of nutrient salts. It is not entirely simple. The fact that boric acid decidedly increased the growth of peas, but never that of barley, raises the interesting question whether boron is in some way advantageous to the pea and therefore to be regarded as a nutrient. Some specific effect is clearly indicated and the hypothesis is shown not to hold in its general form.

Starting from the other end, i. e. from the soil, an attempt has been made to ascertain whether any toxins are thrown off from the roots of plants that will adversely affect succeeding crops. A hypothesis to this effect has long been current, and has been defended by the United States Bureau of Soils. Plants have therefore been grown in succession in the same pots of soil, year after year, and their yields have been compared with those obtained when a rotation was adopted. The results were entirely negative and no systematic difference could be observed : we are forced to conclude that if any toxic property is developed in soil by the growth of a crop its effect is transient and does not persist long enough to affect a subsequent crop.—Monthly Bulletin.

NITROGEN ENRICHMENT OF SOILS.

In this paper the authors summarise their observations and the results of their work in the field and laboratory in Canada since 1905, on the nitrogen enrichment of soils, as follows:—

(1) That, as regards the cultures of nitrogen-fixing bacteria experimented with, while there were many instances in which they distinctly favoured the growth of the legume, their action on the whole was more or less uncertain. The profitable employment of these preparations seems, therefore, problematical. Their vitality is very quickly impaired by light and heat and unless made by a reputable firm or institution, and still fresh, satisfactory results can scarcely be looked for.

(2) The employment, as an inoculating material, of the soil from the surface of a field bearing a luxurious crop of the specific legume has given better results than the use of cultures. Where cost of transportation is not prohibitive, inoculation with soil will be found the most reliable for the general farmer. Provided the proper precautions were observed, the authors have never found it to fail on any soil which merely lacked the specific nitrogen-fixing bacteria. Notable instances of successful inoculation by this method have been recorded for Alfalfa in the North-Western Provinces of Canada.

(3) Failure in many cases has been caused by one or more of the following: deficiency of moisture, unsuitable mechanical condition of the soil due to lack of humus; inadequate drainage, or improper working of the soil, acidity of soil denoting deficiency of lime.

(4) The systematic analysis of a soil continuously in clover shows a constant increase in its nitrogen content. The work reported was continued for nine years, and at every examination the soil was found to be richer in nitrogen. In spite of losses which must have ensued from bacterial activity and other causes, there had been a constant, though not regular, accumulation of this valuable element. The work points to the high manurial value of the residues from a leguminous crop, and emphasises the importance of a rotation which includes a legume, if soil fertility is to be economically maintained.—Jour. of the Board of Agriculture.

LIME FOR THE SOIL.

Lime for agricultural purposes may be air-slaked before use, but another method is to take freshly-burnt stone lime, empty it out of the bags in a suitable place in a heap, and use a watering can to slake it immediately before use. About 1 ton to the acre is used. Quicklime is only used when the soil is strongly acid, or is rendered so by the turning under of heavy green crops for green manure or prickly pear. It can be used also for lightening heavy clay soils, at the rate of from 10 to 15 cwt. per acre.—Queensland Agric. Journal.

SALE OF LOW-QUALITY MANURES AT EXCESSIVE PRICES.

We extract the following from Leaflet No. 270 issued by the Board of Agriculture and Fisheries.—

The attention of the Board of Agriculture and Fisheries has been drawn to the sale as manures in different parts of the country of substances which are practically worthless as fertilisers, and to the sale of manures of low quality, which are offered at prices far above their real value.

The vendors of these substances generally give in their advertisements and invoices a correct analysis of the constituents, and appear to expect that lack of knowledge on the part of the purchasers will prevent them from appreciating the true value of the substance as indicated by the analysis.

For instance, a manure (1) offered at £3.10*s*. per ton, and described as "a complete fertiliser in the cheapest form," is stated to contain the following constituents:—Nitrogen, 1·23 per cent.; soluble phosphates 5·0 per cent.; insoluble phosphates 1·50 per cent. Three other manures offered at the same price contained respectively, according to the invoices, the following constituents:— (2) Nitrogen 1·15 (equal to ammonia 1·40), and posphates 7·0; (3) nitrogen equal to ammonia 1·40, and phosphates 8·0; (4) nitrogen 1·0 to 1·25 and phosphates 6·0 to 7·0.

It may be pointed out that on the basis of the unit values current at about the time the manures referred to were brought to the notice of the Board, the quantities of nitrogen and phosphates contained in them could have been purchased in nitrate of soda, superphosphate of lime, and basic slag at the following cost respectively :—

			s.	d.	s	d.
(1)	Nitrogen 1·23 ...	...	= 14	3	= 26	0
	Sol. phosphates 5·0	...	= 10	0		
	Insol. phosphates 1·5	...	= 1	9		
(2)	Nitrogen 1·15 ...	...	= 13	4	= 21	6
	Phosphates 7·0 ...	...	= 8	2		
(3)	Nitrogen=Ammonia 1·4	...	= 13	4	= 22	8
	Phosphates 8·0 ...	...	= 9	4		
(4)	Nitrogen 1 to 1·25=11*s.* 7*d.* to		14	6	= 18	7 to
	Phosphates 6 to 7=7*s.* to		8	2	22	8

The manures would only be worth these prices if manufactured of first-rate materials like nitrate of soda, super-phosphate and basic slag. Nitrogen may, however, be purchased in cheap forms in organic substances (see Leaflet No. 175, *Waste Organic Substances as Manures*), while insoluble phosphates can be purchased in the form of ground rock phosphates at little more than half the sum they cost in basic slag. Assuming the nitrogen to have been derived from a low-grade shoddy and the phosphates from rock phosphates, the manures could have been compounded at the following cost :—

			s.	d.	s.	d.
(1)	Nitrogen 1·23 ...	...	= 7	4	= 18	5
	Sol. phosphates 5·0	...	= 10	0		
	Insol. phosphates 1·5	...	= 1	1		
(2)	Nitrogen 1·15 ...	...	= 6	11	= 12	2
	Phosphates 7·0 ...	...	= 5	3		
(3)	Nitrogen=Ammonia 1·4	...	= 6	11	= 12	11
	Phosphates 8·0 ...	...	= 6	0		
(4)	Nitrogen 1 to 1·25= 6*s.* to		7	6	= 10	6 to
	Phosphates 6 to 7= 4*s.* 6*d.* to		5	3	12	9

These figures, it will be seen, vary from 10s.6d to 18s.6d. It would indeed be possible to indicate even cheaper materials than those mentioned above, from which "manures" having the composition of (2), (3), and (4) might be prepared, materials which it would not pay the farmer to apply if he got them for nothing !

The loss to the farmer, however, does not lie merely in the fact that he pays £3 10s. for something which at most is only worth 19s. to 26s., and may be worth no more than 10s.6d to 18s.5d. A much more serious loss arises from the fact that the fertilising value of the manure is so low that it may be quite ineffective for the purpose in view.

MANURING EXPERIMENTS IN GERMAN EAST AFRICA.

The question of the use of manures in German East Africa is new, owing to the supposed abundance of nutritive substances in the soil and to the continuous character of the principal cultivated plants (rubber, palms, coffee, sisal, etc.), considered analogous to that of European forest trees.

It is as erroneous to consider the soils of German East Africa very rich as it is to consider them the reverse. In reality there are both kinds, with a prevalence of medium soils, on which it is not possible to continue for a length of time growing impoverishing crops. Consequently the problem of returning plant food to the soil must be faced.

It is also to be remembered that the heat and moisture of the tropics favour an active decomposition of the nutritive substances, and that, especially in light soils, these get washed out by the violent tropical rains. Besides, growing annual and perennial plants together leads to an intense impoverishment of the whole soil Thus, farming based on manuring becomes a necessity, save for the most favoured localities, and as the general use of farmyard manure is impossible, artificials must be resorted to, with the exception of cases in which green manures are used. As for the plan to be followed, an analysis of the soil is no sufficient guide, but experiments in the various estates must be made, considering also the greater cost of manuring under the proposed conditions. It is considered that in order to secure fairly reliable data the experiments must be repeated for five years in an absolutely uniform manner.

Lastly the following quantities are recommended:—

Crop.	Area of plot.	Chloride of potash.	Double superphosphate.	Sulphate of ammonia.
	acre	lb.	lb.	lb.
Cotton ...	¼	33	66	88
Maize & Tobacco	⅛	22	22	44
Cereals and rice	⅛	16½	33	33
Potatoes and beets	⅛	16½	22	44
Beans ...	⅛	16½	28½	23
Vegetables ...	1/40	3¼	4½	8¾
Coffee (1 to 3 years	⅛	11	22	22
,, (3 years)	⅛	17½	33	33
Manihot glaziovii (under 2 years)	⅛	11	22	22
,, (2 years old)	⅛	16½	33	33
Kapok (under 3 years)	⅜	22	44	44
,, (3 years old)	⅜	33	66	66
Coconut and oil palm (under 5 years)	¼	15½	31	31
Coconut (5 years old)	¼	12	44	44
Cacao ...	30 plants	3½ oz	5½ oz	11 oz
Sisal ...	¼ acre	33 lb	44 lb	44 lb
Fruit trees and vines	5 plants	3½ oz	3½ oz	6½ oz
Pasture ...	¼ acre	22 lb	22 lb	66 lb
Clover, lucerne	⅛ ,,	15½ ,,	31 ,,	55 ,,

UNIT PRICES OF

The following statement of cost to the purchaser of 1 per cent. per various sources, at certain Ports and Manufacturing Centres, for June, 1913,

	Bristol		Hull		King's Lynn		Liverpool	
	s.	d.	s.	d.	s.	d.	s.	d.
NITROGEN								
From								
Sulphate of ammonia 95 % pure ...	13	9	15	8	13	4	13	9
Calcium Cyanamide	11	9½	—		12	3	11	9½
Nitrate of Soda pure ... 95 %	16	1½	—		14	7	14	3
Nitrate of Soda pure ... 90 %	—		16	5½	—		15	0
Nitrate of Lime ...	15	6	—		16	0	14	6
SOLUBLE PHOSPHATES								
From								
Superphosphate 35 %	1	9½	1	8½	1	7½	1	9
do 33 %	—		—		—		—	
do 30 %	—		—		—		—	
do 26 %	1	11½	1	10	1	9	1	10
Dissolved Bones ...	2	6	—		—		3	1
Allowed for Insol Phos: ...	*1*	*9*	—		—		*1*	*4*
Allowed for Nitrogen ...	*20*	*0*	—		—		*20*	*0*
INSOLUBLE PHOSPHATES								
From								
Basic Slag ...	—		—		—		1	4
Bone Meal ...	1	4½	1	6	1	16	1	3
Allowed for Nitrogen	*15*	*2*	*15*	*8*	*15*	*9*	*16*	*3*
Steamed Bone Flour	1	4½	1	6½	1	6	1	3
Allowed for Nitrogen	*15*	*2*	*15*	*8*	*15*	*9*	*16*	*3*
POTASH								
From								
Kainit ...	4	4½	—		3	10	4	2
Sulphate of Potash ...	4	10½	—		4	4	4	6
Muriate of Potash ...	4	2	—		3	7	4	0
Potash Salts. ...	—		—		—		3	9

Note.—These uni prices are based on the probable retail cash prices in bags f. o. r. for quantities of not less tha 2 tons of the manures mentioned at the ports and places specified. They are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the

ARTIFICIAL MANURES.

ton of Nitrogen, Soluble and Insoluble Phosphates and Potash derived from is taken from the Journal of the Board of Agriculture.—

London		Newcastle		Newport		Plymouth		Silloth		Widnes	
s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
14	6	14	7½	13	9	14	11½	13	9	13	9
12	6	—		11	11½	11	9½	—		—	
15	6	15	6½	16	1½	15	6½	14	9	14	3
—		—		—		—		—		15	0
15	9	—		15	6	15	6	—		—	
1	9	1	10½	1	10	1	10	1	10½	1	9
—		—		—		1	10	—		—	
—		—		—		1	10½	—		—	
1	10	2	0½	2	0	2	0	2	2	1	10
2	6	3	4½	4	0	5	2	3	2	3	0
1	9	1	3½	1	4	1	3½	1	7½	1	3
20	*0*	*15*	*6½*	*16*	*0*	*15*	*10½*	*15*	*10½*	*20*	*0*
1	3	—		1	4	1	3½	—		1	1
1	7	1	3½	1	5	1	7½	1	7½	1	3
16	0	14	7½	15	2	15	2½	14	7	16	3
1	7	—		1	2½	1	7	1	5	1	3
19	*0*	—		*15*	*2*	*15*	*2½*	*14*	*7*	*16*	*3*
4	3	4	0	4	4½	4	4½	4	4½	4	5½
4	9	4	4½	4	9	4	10	4	10	4	6½
4	0	3	6	—		4	2	4	4½	4	0½
—		—		—		—		—		—	

manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, bags, and loss of weight.

INFLUENCE OF GREEN MANURING UPON GERMINATION OF SEED.

The following is abstracted from the Report of the Director, University of Wisconsin Agricultural Experiment Station for 1911-12.—

In 1911 a southern student at the Wisconsin Agricultural College reported the failure of some ten acres of cotton to germinate, where it had been sown immediately after ploughing under green clover. On the other hand, on a similar field planted with the same seed, but which had not been green manured, normal germination occurred. Professor Hoffmann has accordingly begun a study of the effect of green manuring upon the germination of seeds subsequently sown. In pot tests in the green house he has incorporated with the soil an amount of green clover corresponding to that applied under field conditions, and has then sown various seeds, in all cases sterilizing one series of pots, while another was allowed to remain in a normal condition.

It has been found that the decomposition of the clover somehow affects cotton seed, but does not have any material effect on the germination of corn, (maize), wheat and clover. Two experiments conducted with flax have, however, shown a similar detrimental effect to that produced on cotton. The results so far secured indicate that the decomposition of green manures results in the reduction of the oxygen supply and an increase in the carbon dioxide present in the soil atmosphere. It is thought that this change in gaseous content of the soil prevents the germination of the cotton and flax seed, which contain a high percentage of oil, and so require more oxygen for germination than such seeds as corn, clover and wheat.

THE UNITED KINGDOM—THE WORLD'S MARKET.

"There are now," says the *Live Stock Journal* (January, 1913), about 46,000,000 men, women, and children in the United Kingdom. In the last five years of the nineteenth century, the average annual outlay on food was £365,000,000, or 6d. per head per day—£9 2s. 6d. annually per head of the population. The market value of all the food consumed was almost £300,500,000, or about £7 10s. per head of the population. The outlay on food in the present year is likely to exceed £500,000,000, provided peace prevails; and it may reach £552,000,000, or £12 per head of the population. This outlay is exclusive of ale, porter, wine, spirits, cider, and other beverages; but it includes milk, which is a true food. The outlay on meat, poultry, eggs, milk, butter, and cheese is likely to be over £287,000,000 and may reach £300,000,000. Owing to the greatly increased cost of shipbuilding and the upward tendency of all expenses in connection with the importation of produce, and, further, owing to a marked reduction in the quantity of fat stock that can be spared for exportation from North America, it is certain that our home production will command remunerative prices for some years to come.

APICULTURE.

MANAGEMENT OF SWARMS.

If a bee-keeper desires moderate increase and a crop of honey he should first let his bees swarm, and then set the new colony on the old stand with the old colony by the side of it. In four days he should remove the old colony to a new location, put on a queen-trap, and wait for the second swarm which will issue in from nine to fourteen days from the time the first swarm came out. He should then catch the virgin in the trap, which will prevent the swarm from leaving, for a young queen is very gay. The trap should not be removed until the bees begin to return. Then the old hive should be removed, and another one put in its place. Put the trap on this hive and let the queen loose through the hole in the trap for that purpose. Provide for the bees a frame of eggs and larvæ.

Take the old colony to a new location, and the next day divide it into as many colonies as can be supplied with queen or good cells. Give them a frame of eggs and larvæ. It makes them feel more at home. One should remove all supers from the first colony at the time it is hived. This is the best plan for the novice, and I think for older bee-keepers as well, for there are very few queens that will beat swarming queens.

THE SHAKEN-SWARM PLAN.

Now for swarm control. I use the shaken-swarm plan given in the A B C and X Y Z of Bee Culture when I do not allow natural swarming; only I go a few steps further. I set the old hive by the side of the new colony, and in six days I put on an entrance guard and shake the bees into the new colony again, leaving only enough to take care of the brood and queen. One must be careful if it is a natural swarm or he will find one or more queens on the guards. Now save the best cell or queen, and destroy all the rest if they are not needed elsewhere. Set the old hive on the other side of the new one, leaving an entrance at the further corner. In four days more move it to the other side, leaving the entrance at the further corner again. If it is a shaken swarm, one must raise queens for the hives, for a queen made by a shaken swarm is of no use. Now, if one does not want any increase, leave this old hive by the new one; and, after the flow is over, work the old queen-hive into the new queen-hive.

If I wait a little too late I use the paper plan of uniting, killing the old queen first. The best plan is to remove all the brood from the old queen to the new one every fifteen days as long as there is brood to move, for the old queen and bees are worthless, as they are old, and the hive with the young queen is sure to winter for the bees are all young and there are plenty of them. The old hive and combs may be used the next year. These plans are applicable to a home yard rather than to an outyard, unless the out-apiary happens to be within a few miles of home.

If one has more bees than he wants to winter, he should double up, following the paper plan. If he has a choice of queens he should kill the undesirable one. If he has no choice, he should pay no attention to the queens. The bees will take care of that part of it. In southern Indiana I winter them in two ten-frame stories, and they are boiling over with bees when the flow comes—about May 20.

Put all of the brood and bees into one hive, and put on one super of sections with full sheets of foundation, and another on top of this with drawn combs or one super. Just as soon as the bees begin to draw out the foundation, raise it up and put another under it. If the brood-chamber is not full of brood, use only one super; but in order to secure the best results it should be full. Put an excluder on some of the weak colonies, and stack the empty combs on them about three to the hive, for use later on, for part of these colonies will swarm within ten or twelve days.

One should put the sealed brood in the centre of the hive—that is, if he has a hive full. If not, he should put empty combs in the centre. If sealed brood is placed in the centre, as soon as the brood hatches the queen will fill the cells with eggs and put more honey in the super. If one does not put eggs and unsealed brood on the outside, when the sealed brood hatches they will fill the combs with honey and there will be less honey in the supers, and more swarming, for the bees will always fill the outside combs with honey if they get a chance; and the longer there is brood in them the better.—R. Thompson in Gleanings in Bee Culture.

IS NATURAL SWARMING PROFITABLE OR NOT?

There is not a shadow of doubt in the mind of the apiarist who makes a specialty of bee-keeping but that he would be much better off if bees never desired to swarm; but with the beginner or the farmer bee-keeper there is an element in natural swarming that appeals to him, and to all there is a certain awe fascination on seeing a natural swarm of bees on the wing. I have heard expressions of wonder and admiration come from the lips of all sorts of men and women when seeing a swarm of bees in the air. One of the great things about a natural swarm of bees, and one which can hardly yet be denied, is this: The bees of a natural swarm receive an impetus to work by finding themselves in their newly-pitched tent destitute of brood and provisions, not brought about in any other way. Then if the sections are put over such a swarm as soon as the bees are nicely established in the hive (to an extent where the queen has begun to deposit eggs in the newly-built comb or drawn foundation), section honey can be obtained which is rarely, if ever, equalled by any of the processes of artificial increase yet invented by any apiarist or by any plan of non-swarming.

That there are some weighty objections to natural swarming if could be successfully repressed is not to be denied; but these may be spoken of under two heads—namely, the time and labour required for watching and hiving swarms, and the danger of loss from swarms absconding. It may be held

by some that an undesirable increase would be the greater objection; but with the practical man this should be easily obviated, even to a point of value. If all swarms are to be hived in empty hives, as was the case with those keeping bees fifty or one hundred years ago, then I will concede the point; but with the one who has twentieth-century light it is only a question of the disposal of the brood in the hive from which the swarms issue, and that is generally very valuable, especially in early swarming. Some seem to think that this brood, when emerged into perfected bees or before, should be returned to the identical colony that produced it; but with the practical apiarist it may usually be used with decidedly greater advantage in other ways.

The objection made against swarming on account of the time required for attending to it is not great where the apiary can be located within easy vision of that part of the house where the kitchen work is done, as most prime swarms issue between the hours of nine o'clock and one, when the house-keeper can notify the apiarist if he himself is not at work in the apiary. For the highest success in the production of section honey, strong swarms are desirable; and hiving swarms on the old stand and giving them all the bees which the parent colony contained not only conduces to their strength, but prevents that greatest nuisance, the call of "bees swarming."—Gleanings in Bee Culture.

BEES AND THEIR STINGS.

By WILLIAM BARNES.

In December 1st issue, page 778, I noticed observations in regard to bees stinging each other. My own experience has been somewhat different, for I have noticed on two different occasions stings left in workers after being stung. One was during a case of robbing, and the other where a small swarm had entered another hive of bees. There were dozens of bees with the stings left in their thorax and sides. I saw one bee with as many as three stings lodged in it. Time after time have I watched the effects of a fight since, but have failed to find stings left in the dead bees.

The other day (after reading the articles) a very small queenless swarm came and settled on a hive-cover; and, as I had a very weak queenless colony, I thought I would run the swarm into that hive so as to make them strong enough to be worth a queen if they would unite; but, they didn't. They declared war, and fought it out to the bitter end. I watched the results, and examined the dead bees afterwards, but failed to find even one bee with a sting sticking to it. I myself have never seen either a queen or drone with a sting lodged in it, but have often seen bees bluffing at stinging drones, but never really saw them do it.

I agree with the editor that it is not necessary for bees to lose their stings when using them against each other. I would also go further and say that I don't think it is in accordance with nature for bees to lose their stings, when stinging anything as the loss of the sting is more often brought about by some disturbing agency other than the natural instincts of the bees.

If you see a bee (or feel it) alight on you and sting, don't move, but just grip what you have hold of and watch, wait and suffer. You will see some funny antics (on the part of the bee) in her desire to free herself, which she will accomplish about eight times out of ten if you don't molest it in any way, something after the way in which they free themselves after stinging each other, only it will take much longer on account of having much tougher material to work on. Of course, I am speaking of bees in their normal state, not those that have been stirred up to the pitch when they are just longing to throw away their lives on account of an unnatural state of things being brought about, such as dropping a frame of bees, overturning their homes, or stirring them up with your foot, etc.

In regard to bees stinging animals, the latter, on being stung, will invariably start to play up, thereby angering the bees into doing their best (or worst) by leaving their stings behind, and then trying to do the trick over again.

One remarkable thing in letting a bee extricate itself from your arm or whatever part it has got hold of, is that the pain is most severe at first, and keeps on diminishing until it has freed itself, when a slight rub will let you breathe normal again, and you will hardly know that you have been stung. —Gleanings in Bee Culture.

ROYAL BOTANIC GARDENS.

Visitors to the Royal Botanic Gardens, Peradeniya, for the months of May and June numbered 5,460 and 3,828 respectively.

REMEDY FOR WHITE ANTS.

We publish the following information in reply to a correspondent who has written to us as to the best method of getting rid of white ants.—

The nests should be located and carbon bisulphide pumped into several of the main tunnels all exit holes being plugged up with clay. Care must be taken not to breathe the gas given off or to bring any lighted substance near it.

The "Universal" Ant Exterminator is a piece of apparatus that has given good results in Africa and Ceylon.

The Agents are Messrs. P. Henwood, Son, Soulter & Co., Durban, Natal.

EXPLOSIVES IN AGRICULTURE.

THE USE OF HIGH EXPLOSIVES IN TILLAGE

It is stated in the *Gardeners' Chronicle* for June that a party of agriculturists, horticulturists and foresters visited the nurseries of Messrs. Dicksons & Co., Craigmillar, Edinburgh, in order to witness some experiments with high explosives in breaking up impervious sub-soils. The substances used were gelignite and polarite. In the first experiment, polarite cartridges were inserted at a depth of 2½ feet and 5 feet apart; and, in the second, ordinary gelignite charges were inserted at a depth of 3¼ feet and 6 feet apart, and all were fired by means of a safety fuse. So far as the operation of blasting went, everything passed off successfully, but it was soon apparent that the tough clay, of which the subsoil in this case consists, was not easily shattered by this means, and that to do it effectively the charges would require to be placed much more closely than at 5 feet intervals, which, however, would make the cost prohibitive. The operations were carried out by Messrs. Nobel.

DYNAMITE IN THE ORCHARD.

Some of the Beaconsfield land owners have found the use of explosives a cheap and effective method of clearing the land in preparation for planting. At a demonstration given for the information of the writer, Mr Geo. Knox exploded four plugs of dynamite underneath a 12-in. dry stump, with the result that the latter was blown clean out of the ground and thrown a distance of about 15 yards. Six plugs were placed under a much larger stump and although the explosion was not sufficient to remove it bodily, it was completely loosened, and might easily have been pushed over with a jack. Eight plugs, costing with cap and fuse, about 9*d*., would have lifted it right out. Such a stump could not be hand grubbed for less than 2*s*. The process is a very simple one; a 2-in auger with a long shank is used for making the hole, which is driven as far underneath the tree as possible; all the sticks of dynamite or gelignite save one are broken into pieces and pressed into the hole by means of a wooden rod; the last stick, fitted with cap and fuse, is then inserted and tamped in with a few inches of soil on the top. The fuse is timed to burn at the rate of 2 feet per minute, so that a 3 ft.-hole gives the operator one minute and a half to get away. Very little soil is blown out of the hole, but the ground is left so completely pulverised that the wooden rod can be thrust into a depth of 3 or 4 ft. below the bottom of the excavation, and for a considerable distance all around. There is no bank of earth to throw back, as there is after hand grubbing, and the hole is easily and quickly filled in. The saving in time is considerable, as a big stump can be blown

out "while you wait," with very little more labour than a small one. To show the value of dynamite for subsoiling, Mr. Knox exploded a single plug in a 3 ft. auger hole, with the result that the soil was loosened up within a radius of 5 or 6 feet, and the rod was easily thrust in to a depth of 3 or 4 ft. This by no means indicated the limits of the effect of the explosion, the ground being doubtless shattered much further than could be probed with a blunt stick It appeared as though a cartridge at every 10 or 12 ft. would break up the whole of the subsoil more effectively than any other method, and leave the ground in excellent trim for planting. Where subsoiling was not necessary a couple of cartridges exploded at every spot where a tree was to be planted would be a splendid preparation. In removing stumps judgment is required to put sufficient explosive into the hole without using enough to produce an unnecessary disturbance. It is not the sort of work to give a stupid person to do, but with due care there need be no accident. One of the settlers has an excellent electrical apparatus for exploding a number of charges at one time without the use of fuse. This outfit cost £15, but where a lot of work is to be done it saves time, besides reducing the risks.—Melbourne Leader.

DESTRUCTION OF LANTANA.

This plant is apt to become a great nuisance in tropical countries on cultivated and pasture land, owing to its dense growth and extraordinary vitality. It appears from the *Journal d' Agriculture Tropicale* (1912, 12, 154) that an attempt is now being made in New Caledonia to combat the pest by introducing a species of fly of the *Agromyzidæ* family from Hawaii. The insects have been distributed in the environs of Noumea on land infested with lantana. As a result, the larvæ of the fly have been found in many of the seeds, and it is intended to extend its distribution in the colony. The result of the experiment will be watched with interest; it must be borne in mind, however, that where a new animal species has been introduced to destroy some pest it has itself sometimes proved to be injurious in other directions —Imp. Inst. Bulletin.

BIRDLIME.

Birdlime is made by boiling down linseed oil. If boiled oil is used, the concentration takes less time than with unboiled. Treat the oil as you would glue. Put it into a tin. Place the tin in a saucepan of boiling water over the fire, and let it boil slowly till thickened.—Queensland Agric. Journal.

AGRICULTURAL EDUCATION.

By C. F. BAKER

Professor of Agronomy in the University of the Philippines.

The scientific development of Tropical Agriculture has been brought about not so much by the slow evolution of a native peasantry, as by direct Government influence and assistance, encouraging the investment of large foreign capital in extensive estates and assisting the development of these by colonial departments of agriculture, botanic gardens, and experiment stations. This is in sharp distinction to the course of events in the most advanced of temperate regions where the inspiration and energy for advancement have come out of the native peoples themselves. Much of recent rapid estate development in the tropics has occurred in countries already more or less thickly inhabited by essentially agricultural peoples, and this movement has been of infinite service in the opening up of these countries, and in building foundations for the civilizations possible therein. Government attention has been largely centred in the interests of this estate development; but even in some countries where it has been most rapid, the amelioration of conditions surrounding the native peoples has proceeded but slowly. It is true that law and order have come with the foreign occupation, that larger possibilities have been opened up, and that the sanitation of these countries has proceeded apace, though it must also be said that many evils have followed close upon the advent of the "higher" civilization. Educational development has been slow. The improvement of native methods in agriculture has proven a difficult undertaking. The increase of estates in some regions has rather tended to decrease even temporary land tenure among the natives, and to reduce large bodies of such natives to the comparatively hopeless condition of day labourers, or worse. That the virility and manhood of a people, and the possibilities of the development of a strong native civilization, would be increased by the estate development alone, might be fairly questioned. So that the matter of the education of the native peoples of tropical lands, the settling of their families on permanent farms of their own, and the improvement of their agricultural methods—so essential everywhere to their personal welfare and their civic growth has become one of the foremost problems, as also one of the greatest moral responsibilities facing colonial as well as independent governments.

These problems are new problems, in natural settings, with surrounding conditions, and with human material in the making, far different than are to be found in any temperate region. To attempt to apply the methods, and to immediately ingraft the ideals, of other lands and climes, results in difficulties which can only be appreciated by those who have tried to accomplish this, as

it were, "by proclamation." Methods will evolve but slowly and must be built upon the safe foundation of long and varied experience. That the general intellectual status of the masses must be raised, is granted. That it is often readily capable of being raised, is also generally granted. That it must be raised in constant and specific relation to the greatest life interests of these peoples, with the concomitant development of those interests and the closer binding of the whole people to them, is patent on the face of it. And that brings Agriculture into the very foreground of the whole problem.

Efforts in these directions, of many sorts, are being made under many governments. The great centres for technical work and investigation that have been established in many tropical countries, primarily in many cases for the service of the estate development, have, in later times, been attempting to serve the interests of the whole people. Branch experimental stations and demonstration farms have been established at great expense, but the work of these institutions has often proven quite ineffective and indefinite, as regards the general good. The country must be filled with native elementary schools to begin with, to be manned by trained native teachers. School gardens that are neither demonstration farms nor experimental stations should exist in every school, and made living wells of attractiveness and interest, aiming to inculcate from the beginning, familiarity with plants and the growing of them, deep interest in them and abiding love for them. From these schools the brightest children should be carried on to the High School, and here should be laid the broad foundations in Mathematics, Physics, Chemistry, Botany, and language, that shall make a modern technical agricultural training possible. The practical means for drawing the brightest students to the High Schools has been solved in various ways, one of which is the appointment of "pensionados" by the various municipalities, up to the limit of their means, these students pledging themselves to a certain term of teaching service later on, in the same locality.

The centre and soul of this whole system, so far as agriculture is concerned, must be the agricultural college, a technical school of college grade, where students may receive all the necessary advanced training to make them really scientifically expert practical agriculturists. This college should carry not less than a four years course, and be manned only by the best trained men of any nationality, from the foremost agricultural colleges and university laboratories of the world. The existence of a single man in any chair in an agricultural college who is not a thorough master of his subject, and not willing to live up to the highest ideals and purposes of such a college, may seriously vitiate and cripple the work of the whole institution. In new countries where a sufficient number of High Schools have not yet been organized, a preparatory school, carrying a two years' course, and equivalent to a first class High School, should be incorporated in the Agricultural College, so that students may be received directly from the common schools. There are many distinct advantages in this. The preparation of students received from scattered High Schools is usually uneven in character, and commonly the curricula of such schools articulate very poorly with that of the agricultural college, compelling the conditioning of many students from such sources before they can enter the regular work in the agricultural college. On the

other hand, the preparatory school within the college is calculated to fit students for just this college, and the work being done on the same ground, with constant reference to agricultural crops, methods, and conditions, in the elementary botany and other subjects and the use of material drawn from these sources in the laboratories, *is an immense advantage.* Indeed it might not be going too far to say, judging from experience, that with this preparatory school under the same general direction as the agricultural college, better results are obtainable than by any other system.

(To be Continued)

THE COLONIAL AGRICULTURAL COLLEGE AT TUNIS.

The Colonial Agricultural College at Tunis was founded in 1898. Since then it has been attended by upwards of 300 students; of these 97 are engaged in farming in Tunis and 32 in Algeria; 20 who have remained in the colony have taken up professions which are only indirectly connected with agriculture; 103 have returned to France and are occupied in farming; the others are in Morocco (7), in Indo-China and Madagascar (17), in America, Egypt and Tripoli (8); lastly there are 16 in the military service and 9 have died.

THE COLLEGE FARM.

The college farm disposes, since last year, of a cultivable area of about 400 acres, of which 54 acres are under vines and 22 under olives. The property is provided by means of underground wires with electric power for the agricultural machines.

COLLEGE EXPERIMENT STATIONS.

At present three experiment stations are connected with the college: for agriculture and agricultural botany, for the technique of farming and irrigation, and for agricultural parasitology. In order to keep the college in touch with the Central Station on the one hand and with the branch Stations and the farmers on the other, the Director of the Central Station was appointed inspector of agriculture for the whole colony. In the year 1910-11, 688 cwt. of improved seed wheat which had proved the best for the region were distributed among 60 colonists and as many native farmers. Last year one half of the available area of the college farm was devoted to the production of the best seeds.

Numerous experiments have been conducted on various systems of farming, on the use of new implements for dry-farming, on methods of sowing, on application of manures, on the growing of several varieties of

cotton, forage plants and vines, on the work of draught animals, on the use of windmills, on evaporation from the soil, irrigation, control of plant diseases and parasites, etc.

THE CURRICULUM.

The curriculum is that of a college of agriculture. In the near future the successful passing of examinations at the end of a two-years course of instruction will confer the title of colonial agricultural engineer.

The object of the foundation of this Institute was to give the future colonists of North Africa an opportunity of obtaining a thoroughly good agricultural education, both theoretical and practical, in the country itself in which they intended practising. For this reason the school receives, besides regular students, other pupils, the so-called "stagiaires agricoles." These are either intending colonists who have already gone through an agricultural college in France or who have already been engaged in practical farming in Europe and who wish to become acquainted in the shortest time possible, with the special conditions of farming in a dry climate, before undertaking operations on their own account. The occasion to learn practically as volunteers on private estates but rarely occurs, as colonists accept only those young men whom they have previously known. On the property and experiment fields of the Institute the students can follow all the various operations and attend the lectures and practical exercises which interest them as well as the courses of Arabic.

By their intercourse with their fellow students, professors and colonists, they learn the habits and customs of the country ; they can afterwards extend and complete their practical knowledge in any private farm and finally utilize it to advantage in their own farms.—Monthly Bulletin.

AGRICULTURE IN SOUTHERN NIGERIA.

The Report of the Director of Agriculture of Southern Nigeria for 1912 contains accounts on Cacao, Rubber, Cotton etc. The cacao industry has received considerable attention and nearly 40,000 plants and over 12,000 seeds were distributed by the Department during the year. With a view to improving the quality of the exported article, drying houses and fermenting boxes have been established and very satisfactory results have been achieved. The rubbers under cultivation in Southern Nigeria are the *Hevea brasiliensis* and *Manihot glaziovii* while *Funtumia elastica* and species of *Landolphia* and *Ficus* are indigenous and occur in fairly large quantities.

AGRICULTURE ABROAD.

THE CULTIVATION OF WITLOOF CHICORY IN BELGIUM.

By HENRY CHEAVALIER,
Professor of Horticulture.

During recent years the cultivation of Chicory has become a very important industry in Belgium, says the *Gardeners' Chronicle*, and the market growers of that country export large quantities of the vegetable to Great Britain, France, Germany, Holland and even America. On the Continent, especially, the "chicons"—as the blanched heads are known—are largely used as salading, and sometimes they are eaten as a cooked vegetable. It is just 67 years ago since the first "chicons" or blanched leaves were grown in the town of Schaerbeek and carried on the heads of the growers to the Brussels market. As showing how the industry has grown, it may be stated that in the Brussels district alone some 7,136 acres are devoted to the growing of Chicory. The principal market gardens are found at Evere, Haeren, Neder-over-Heembeek, Dieghem, Saventhem, Woluwe-Saint-Etienne, Machlen, Melsbroeck and Vilvorde. In addition, Chicory is grown near most of the large towns in Belgium, including the neighbourhood of Louvain, Malines, Ghent, Antwerp, Mons, Tournai, Namur and Huy. Between October and April Witloof Chicory is despatched to all parts, and from the Railway Station at Schaerbeek alone is sent every year more than 7,717,751 lb. weight of the vegetable, the greater part to Paris. The exportation of the vegetable to New York has increased very much during the last few years. On December 28th, 1912, there were despatched from Antwerp for New York 1,633 baskets, each basket containing 22 lb. of Chicory. In January, 1913, more than 6,000 baskets were despatched to America. The following figures illustrate the growth of the trade with the United States :—

Months.	1909.	1910.	1911.	1912.
January	1,869	3,676	3,200	3,064
February	2,408	3,367	3,654	2,877
March	1,822	3,408	4.039	3,774
April	2,755	3,448	3.735	2,243
May	1,722	35	1,379	—
September	865	681	1,739	1,865
October	2,334	3,104	2,325	3,180
November	1,809	2,477	2,947	3,572
December	1,715	3,826	3,467	3,874
Totals (lbs.)	17,299	24,022	26,527	24,449

But these figures do not represent the total quantity, for from London the Atlantic Transport Company tranships from 22,000 lb. to 26,000 lb. per week. Every week in the season Brussels sends to London by way of Antwerp and Harwich, or Ostend and Tilbury, an average of 32,878 lb. In addition to all this, buyers in Holland take 220,000 to 264,000 lb. per month. Trade with Germany accounts for 1,765 lb. per month, whilst Switzerland receives 80,871 lb. per month, and the trade with that country is increasing every year. The principal varieties of Chicory cultivated are :—(1) The wild or coffee Chicory, which has been cultivated for numbers of years as a salad vegetable ; (2) Witloof, or Improved Wild Chicory, which originated in the neighbourhood of Brussels. The leaves of this variety are very large and make good heads. (3) The large root Chicory, or Brunswick variety. This sort has shorter roots than the Witloof, and is suitable for growing in a shallow soil that would not be deep enough for the Witloof.

METHODS OF CULTURE.

Ground for Chicory needs to be fairly rich in manure, deeply cultivated, and not too heavy in texture. The Belgium growers trench the ground a year before planting, incorporating with it a heavy dressing of farm-yard manure. The manure is well decayed when the time for planting arrives, and this is important, for fresh dung would cause the roots to become coarse, forked, and altogether unsuitable for forcing. The best time to sow the seed is the middle of May ; if sown earlier the plants may flower prematurely, and as a consequence the roots are weakened and rendered useless. The seeds are set very thinly in drills made an inch deep and drawn at 10 ins. apart. They are covered with fine soil and made firm by rolling. During warm weather the seeds soon germinate in most soils. When the seedlings are a few inches high they are thinned to 10 in. apart in the row. The soil is hoed frequently to destroy weeds and loosen the surface. It is necessary to allow all the leaves to develop, for if any are removed the roots suffer. Plants that show signs of flowering are removed at once and discarded. By the end of October, the roots are lifted for blanching. If more are lifted than are required, the surplus ones are placed in a trench and covered with dead leaves to protect them from frost. When the Chicory is lifted the head is cut off with about an inch of the crown of the root. Blanching is commenced in October, when the demand for forced vegetables begins. There are several methods of blanching :—(*a*) The roots may be forced in a dry, dark cellar, on a mild hot-bed made with fresh horse manure. The bed is made 2 feet thick and 6 feet wide, the length varying according to the width of the cellar. When fermentation causes the dung to become hot the bed is covered with a layer of rich, light soil to a depth of one foot. As soon as the soil becomes warm the roots are planted close together in rows each row being 6 ins. apart. It is important to arrange the crowns all at the same level, and they are then covered with 8 ins. of very light soil. To furnish a succession of "chicons" all through the season it is necessary to make a fresh bed every month. (*b*) The forcing may also be done in a warm green house, when the arrangement of the roots is the same as in the beds in cellars. In all cases the forcing must be done in complete darkness.

FORCING IN THE OPEN.

Chicory may be forced in trenches made out-of-doors. The trenches are 16 ins. deep and 1½ yards wide, and the roots are planted closely together in rows, always at the same level. They are first covered with a 12 in. layer of light soil, and afterwards with a bed of fresh stable manure. The manure must be well trodden and 20 to 24 ins. in depth. By this method the heads may be gathered in three weeks from the time of planting.

FORCING IN FRAMES.

The market growers use portable heated frames known as thermosiphons. This is the best method of all, and produce grown in this way is always of the finest quality. The hot water pipes are set either above or under the soil. The temperature is maintained at 60° to 70° Fahr., and it must never be allowed to rise higher than 77°. The trenches are made as described before, the roots being covered with soil. If any of the roots are too long they may be shortened a little. The crowns are covered with good soil to a depth of 12 ins., and the lights are then placed in position. The temperature may easily be regulated. By this system the crowns may be gathered after the second or third week of forcing, and a succession may be obtained from November to April.

AGRICULTURAL DEPARTMENT OF INDIA.

A Report on the Progress of Agriculture in India in 1911-12 has been issued by Mr. Coventry, Agricultural Adviser to the Government of India. From the general introductory sketch it is apparent that considerable work of a practical nature has been carried on in connection with cotton. The area under this crop has increased enormously, and an improvement of the quality of lint by means of seed selection and distribution has also been effected. But the author of the report is of opinion that the problem of cotton improvement in India is not so much concerned with quality or the increase in the length of the staple, since it has been found that a larger yield and a greater ginning percentage combined with hardiness of habit in the plant means more money to the cultivator than length of staple.

Special mention is made of Dr. Coleman's work in Mysore particularly in the demonstration of improved practices and organised campaigns against plant diseases and pests. A map is attached which indicates the activity of Dr. Coleman's department.

Mention is also made of Major Holme's veterinary work in connection with rinderpest and its suppression by means of an antiserum.

Mr. Coventry referring to Agricultural Education, recognises two aspects of the question (1) improved practices in agriculture which constitutes the foundations of agricultural education for the cultivator and (2) Agricultural Teaching in Colleges for the more highly educated and well-to-do classes. As regards the former he says that there is a growing recognition of the value of the Co-operative movement and the Agricultural Department is beginning to get more and more into touch with Co-operative Societies. Efforts are

being made to bring these Societies and Agricultural Associations into analogous relations with the Agricultural Department.

As regards Agricultural Education in Colleges the most promising line of development he says is to be found in the extension of practical instruction by providing a regular course of work on the land for the student.

C. D.

KALALGAMUWA EXPERIMENT GARDEN.

CULTIVATION OF CHENA.

The 3rd year's experiment in continuous cultivation of chena lands at Kalalgamuwa has just been completed.

A four-course rotation has been adopted from 1910, viz:—Cotton, Root-crop, Legume and Grain.

The rains at the commencement of the planting season (viz., November) lasted an unusually long period and caused much damage both to the ground and the crops.

In plot No. (1 ¾ acres in extent) under a grain crop, Hickory King maize was planted in mid-November in rows 3-ft apart. Originally 3 seeds were put in each hole, but only the best plant was allowed to grow. A crop of 3000 cobs was obtained and realised Rs 35/- selling at 1 and 1½ cents per cob. The plants produced 1 cob each: last year some plants produced 2 and occasionally 3 cobs.

In plot No. 2 (under a root-crop) 1½ acre were planted with cluster sweet potatoes and ¼ acre with potatoes. The sweet potatoes gave a crop of 7500 lb. tubers in 4 months and realised Rs. 120/-; 220 lb. of potatoes were planted 2 ft. apart in beds 4 ft. wide and yielded 900 lb. in 4 months valued Rs. 67/-.

In plot No. 3, under cotton, Allen's Long staple was planted but owing to damage done by the rains vacancies had to be supplied more than once and in the end the crop was entirely spoilt by the rain. The ¾ acre only gave 153 lb. of seed cotton.

In plot No. 4, under legume, two crops were sown, viz, *Vigria sinensis* and kollu (*Deliobes biflorus*) in drills 1½ ft. apart. The amount of seed utilised was 2 measures of each. The former gave 36 measures or 18 fold and the kollu 40 measures or 20 fold—a comparatively poor yield.

Considering that Dumbara is a great "chena" district, the experiment is an important one for the locality and is being carefully watched.

Already the benefits of a rotation of crops are beginning to be appreciated

W. MOLEGODE,
Agricultural Instructor.

OSTRICH FARMING

ORIGIN OF OSTRICH FARMING.

Ostrich farming was begun by the catching of wild birds some time between the years 1857-60. As far as I can gather the two men who are entitled to be called the fathers of the ostrich industry are Messrs. Van der Westhuyzen and Gert Olivier. They caught many wild birds which were then running on the flats, domesticated them, and bred from them. The feathers of these wild birds and their progeny were in great demand, and from £20 to £30 was paid for the full plumage of a single bird. I well remember on the market here an uncle of mine getting £20 apiece for the plumes of twenty-two birds. Nowadays, for far finer feathers, £6 is a fair average price. Some twenty-five years ago (1886-88) there was a bad slump in the price of feathers, which then realized only from £2. 10*s*. to £3 per plucking. At that time there seemed to be no demand for feathers.

The credit of first introducing lucerne to Oudtshoorn is due to a former magistrate, Mr. Scholtz. He sowed a small patch in drills in his garden. A little later my uncle, Richard Gavin, arrived from Ireland. He noticed this leguminous plant and thought it very like the clover of his old home. Accordingly he sat down and wrote to Phillip Bros., seed merchants, at Capetown, and asked them to procure some seed for him. This he sowed broadcast on a piece of land which is now a part of High Street and there it grew luxuriantly. Then another of my uncles, James Gavin, bought a similar bit of ground which is now a portion of Queen Street. Here he likewise planted lucerne.

One of the first farms on which lucerne was planted on a large scale was Welbedacht ("well thought of"), which was owned by the Gavin Bros. I believe I am correct in saying that they were the first farmers in South Africa to realize that lucerne fodder could be used not only to feed ostriches, but also for all kinds of live stock as well. Before their experiments it was practically unknown in this country. Since then every year more and more land has been laid down to lucerne, until you now see the large area under this crop in this district alone. You will not be surprised to learn that we consider it a truly wonderful plant. We can keep six birds to the morgen on irrigated lucerne land, and we can safely reckon on an average price of £8 to £9 for the plumage of good birds. The annual value of the output of feathers from Oudtshoorn is now close on a million sterling.

WHAT CAPITAL IS REQUIRED FOR OSTRICH FARMING?

Around Oudtshoorn a great deal is required when compared to other branches of farming in other parts of South Africa. This is mainly due to the very high price which must now be paid for land under water and lucerne in this district. Some of my neighbours are now buying more land for their ostriches at £300 per morgen. You may be interested to know that the whole of the arable land of the Oudtshoorn District, i.e., land under the plough and the furrow, is rated by our Divisional Council at an average price of £150 per morgen. In the face of these facts I would say that the prospective ostrich farmer should have £5,000 to start with in this district. Nevertheless, the majority of our well-to-do farmers began their careers with little or no capital.

Let us suppose that a thrifty colonist buys ten morgen of lucerne land under water with certain grazing rights, and pays at the rate of £200 per morgen £2,000. He must then buy three pairs of birds at, say, £150 per pair, or £450. Next, he proceeds to erect outhouses, incubating rooms, and rough sheds for the chicks—the cheaper the better, because ostriches should not be pampered. Then he must purchase a wagon and mules, a span of oxen, ploughs, cultivators, and other farm implements. The cost of all this equipment may be placed at £1,000. Wages and the cost of fencing must also be taken into account. A simple homestead may have to be erected ; so that by the end of the first year he will have expended a fairly large sum of money.

With us the birds are mated in March and April. We allow the chicks to run with their parents until they are from two to three weeks old. Then we wean them and let them run on lucerne, giving them in addition crushed barley, bone meal, and limestone to aid their digestion. Many farmers run their birds on growing lucerne, but the best and most economical plan is to cut it and feed it in separate paddocks. There is less waste by this method and the plants are not injured by too close cropping. Young birds running on tender lucerne are liable to suffer from liver troubles. Old birds are seldom so affected.

The first feathers are pulled when the birds are from eight to nine months old. Some farmers clip their chicks when they are four months in order to form an even crop of feathers later on. The weight of a chick's feathers is usually from five to six ounces, and is valued at 45*s*. per lb. After six months we clip the wing feathers and the largest blacks, and pull the others. The first crop after the chick stage is worth from £6 to £10. Next, in from two to three months we pull the quills of these same birds, and six months later we have another plucking, and so on. That is to say, we have on an average three plumages in two years and two months. Ostriches often live twenty years and more. But after their fifth plumage they seem to deteriorate and the feathers become narrower, shorter, and lighter. A mature bird gives eight ounces of wings and about sixteen ounces of tails and

blacks or drabs. I have known some birds to give twelve ounces of wing feathers. The record price for a pair of ostriches in this country is £1,000. The largest ostrich farmers in South Africa are the Potgieter Bros. They own over 5,000 birds. Most of our feathers are sold locally, as we find that we get higher prices from the Oudtshoorn buyers than anywhere else in South Africa. These buyers ship direct to London, Paris, and New York.

WHY IS OUDTSHOORN SPECIALLY ADAPTED TO OSTRICH FARMING?

There are three main reasons. Firstly, the climate. The ostrich thrive best in a dry climate. Aridity is essential to the production of the finest feathers. The ostrich can stand a great deal of heat, but he does not like dampness nor extremes of heat and cold. Secondly, the Karoo soil of the Oudtshoorn valley is specially suited to the bird, probably due to the fact that it contains a good deal of salt and lime. Lastly, Oudtshoorn is well watered by two perennial rivers which make possible the growth of lucerne, or, in other words, a rich and abundant food supply. The pedigree ostrich, like the thoroughbred horse, needs to be well fed and well cared for if he is to give the best results. Neither ostriches nor horses can be expected to thrive if they are left to starve on poor veld grass.

The Oudtshoorn valley is roughly 70 miles long by 35 miles broad. We utilize the waters of the Grobbelaars and Oliphants Rivers for irrigating our lucerne lands. A large portion of our valley is composed of rich loamy soil. We find that lucerne does best in a sandy loam which has a substratum of lime. Our average annual rainfall is 10 inches. This is a very important point. Take, for example, the ostrich country around Grahamstown, where the rainfall is 30 inches per annum. There the farmers cannot produce three crops of feathers in two years—as we can—because there is too much moisture. Suppose rain falls when your feathers are ripe to clip it discolours them and spoils their lustre. Coming nearer home, the same thing is true of the ostriches in the Districts of Mossel Bay and George, where the precipitation is so much heavier than with us. Birds removed from the sea-coast to the Oudtshoorn valley pick up at once, and their feathers begin to show that extraordinary lustre for which our district is so justly renowned.—N. H. O. Gavin in the Agricultural Journal of U. S. Africa.

GENERAL.

THE CEYLON AGRICULTURAL SOCIETY.

REPORT FOR 1912-13.

PRESENT POSITION OF THE SOCIETY.

The last Annual General Meeting of the Society was held on July 3rd, 1912, at the All-Ceylon Exhibition grounds in Victoria Park, His Excellency Sir Henry McCallum presiding.

During the year under review 93 new local members joined the Society.

In addition (and as the result of the purchase of the *Tropical Agriculturist* from Messrs. A. M. & J. Ferguson) 677 foreign subscribers were taken on the Society's list, and 62 joined subsequently.

The total number to-day is as follows:—local members 828, foreign members 876 or a grand total of 1704 members.

A directory of Subscribers will be found embodied in the Society's Year-Book.

STAFF.

The new official financial year sees provision made for agricultural administration through a Department. The Society's staff of officers (itinerary and clerical) have not yet been absorbed into the Department: so that the Society will during the coming year fill the *rôle* of handmaid to the official organisation. In this capacity it has great opportunities for proving its usefulness in bringing the Department into close touch with the cultivator.

The official status of the Department enables it to lay down a definite policy and also clothes it with the necessary authority for enforcing its measures; while on the other hand the unofficial character of the Society gives it opportunities for studying first hand what may be called the internal conditions of agriculture. The co-operation between the two is, therefore, a happy one and should result in practical and effective measures.

Under the departmental classification, the Secretary's official designation is Superintendent of the Division of Low-Country Products and School Gardens.

Three additional agricultural instructors have been appointed to make up the full complement of 12. This addition will allow of more time being given to special areas and better attention to outlying districts. The following is the complete list of Instructors:—L. A. D. Silva, S. Chelliah, W. Molegode, C. K. Sathasivam, N. M. Jayasuriya, P. B. M. Bandaranayake, M. J. A. Karunanayake, A. Madanayake, J. R. Nugawela, D. V. S. Goonewardene, C. H. de Saram and L. de Z. Jayatilleka.

It is gratifying to find that most of these instructors thoroughly understand their duties and their relation to the cultivator on the one hand and the Government Official on the other. They have thereby won the confidence of the former and the good opinion of the latter.

I should wish to place on record the loyal services rendered by my Chief Clerk (Mr. J. S. de Silva) who has been connected with the Society from its inception. Capable and experienced, Mr. de Silva has performed the arduous duties of his office with conspicuous ability.

PUBLICATIONS.

As the result of the purchase of the *Tropical Agriculturist* it has been possible to effect alterations in the Magazine, as regards arrangement of matter, printing, &c., with a view to making it more attractive. Started in 1881 by Mr. John Ferguson who ably edited it for 23 years, the publication has steadily grown in importance till it has come to be recognised as the foremost unofficial organ of Tropical Agriculture, with a circulation that carries it to all the ends of the earth.

The Govikam Sangarawa or Sinhalese Agricultural Magazine is proving very popular among the agricultural classes in the Sinhalese districts, and is, moreover, read by every Government village teacher. The circulation has increased from 1500 to 3250 within the year. It is without doubt a most valuable medium for the dissemination of agricultural information.

I regret to say that the Tamil Agricultural Magazine *(the Kamat Tholil Velakkam)* has not appealed to the Tamil cultivator to the same extent. The reason for this is not quite apparent, but arrangements have been made to edit the magazine on more popular lines.

The Society has this year issued a small Year-Book in place of the usual sheet calendar. By this means it has been found possible to compile a good deal of useful information and place it in the hands of members at the modest price of 50 cts. per copy.

A list of occasional publications in the form of leaflets, available to members free of cost, will be found in the Year-Book.

A GENERAL SURVEY.

While the Rubber market is adjusting itself after a manner that is somewhat disconcerting to the producer, tea preserves a steady course, and coconuts may be said to have reached their zenith. The interests of these planting products are receiving the best attention both from a scientific and practical point of view, and special provision has been made for research and experimental work. The opening of a coconut trial ground has been welcomed by Low-country planters and should materially assist in the further development of the industry by increasing the yield of nuts. The question of turning out a superior quality of copra is also being seriously considered: but the adoption of improved methods will greatly depend upon the attitude of local buyers who at present cannot be said to be offering any definite encouragement in this direction, depending as they do upon empirical tests which are scarcely a true basis of valuation.

The Agents of the British Cotton Growing Association (Messrs. Freudenberg & Co.) are trying hard to develop a local cotton industry, but the present period of agricultural prosperity is hardly opportune for pushing a comparatively new product, though the Society's cotton trial at Ambalantota in the Hambantota district last season gave most encouraging results. Cotton must be looked upon as a cash crop for the small cultivator, and the most

THE CEYLON

STATEMENT OF RECEIPTS AND PAYMENTS FOR

RECEIPTS.			Rs.	Cts.	Rs.	Cts.
To Balances at Bank of Madras &c. 31 Dec. 1911.					37930	28
,, Members Subscriptions.						
Local Subscriptions for 1908			16			
do 1909			8			
do 1910			168			
do 1911			588			
do 1912			4032			
do 1913			504			
do 1914			8			
Foreign Subscriptions		492·00				
less paid to "Ceylon Observer"		9·00	483			
Life Members' Subscription			50		5857	00
,, Government Grant for 1912.					30000	00
,, Agriculture						
Refund of amount overcharged		90·90				
Sundry Recoveries		14·65	105	55		
Less Sundry Expenses.			70	10	35	45
,, Interest						
On Bank of Madras a/c					712	15
,, Seed Supplies.						
Excess Sales over Purchases.					486	10
	Purchases.	Sales.				
Vegetable Seeds	176·77	243·00				
Paddy	46·16	101·25				
Cotton	50·17					
Grafted Plants	1494·42	1745·75				
Cangayam Grass	8·63					
Soya Beans	10·00	45·25				
T Purpurea	13·00	133·40				
Coconut		40·62				
Chilly		7·40				
Grass		6.25				
P. Lunatus	5·00	6·94				
Coffee	12·00					
Cane	9·97					
Sundries	30·14	12·50				
	1856·26	2342·36				
Excess Sales		486·10				
		Rs....			75020	98

We certify that we have prepared this account of Receipts & Payments from the books

Colombo 23rd April, 1913.

AGRICULTURAL SOCIETY

THE TWELVE MONTHS ENDED 31st DECEMBER, 1912

PAYMENTS.			Rs.	Cts.	Rs.	Cts.
By General Expenditure.						
Organising Vice-President	2500	00				
Secretary	3000	00				
Clerks & Peons	3807	56				
Agricultural Instructors	4629	48	13937	04		
Stationery			209	70		
Postage & Telegrams			853	79		
Office Furniture			24	71		
Bank Charges & Commission			18	70		
Miscellaneous Petty Expenses			584	54		
Auditors' fee for 1911 ...			150			
Advertising			12			
Upkeep of Bull			80		15870	48
.. Travelling Expenses.						
Secretary			2034	08		
Agricultural Instructors			8256	45		
Show Judges, &c.			169	90		
Organising Vice-President & Staff ...			75	25	10535	68
.. All-Ceylon Exhibition, ...						
Expenses in connection with the above ...					1625	53
.. Tropical Agriculturist & Magazine of C. A. S.						
Printing English Magazine	4578	75				
do Tamil Edition	200	00	4778	75		
Less Singhalese Magazine ...						
Subscriptions received	1140	89				
Deduct Editor's Fee 450·00						
do Printg. Postg. &c. 662·80	1112	80	28	09	4750	66
. Agricultural Show Expenses.						
Market Shows			150			
Cost of Medals			280			
Grant to Akmimana			50		480	00
.. Sericulture Experimental Farm.						
Grant to the Salvation Army					1000	00
.. Experimental Gardens.						
Kulalgamuwa.			250			
Bandaragama, Kegalle & Madipolla ...			450			
Balangoda			129	10		
Balalla			160	65		
Hettipola, Nikeweratiya & Ambalantota ...			424			
Kahawatte			90		1503	75
.. Seed Store at Government Stock Garden.						
Coolies' Wages			180			
Seed Bags			17	25		
Miscellaneous Expenses			215	45	412	70
.. Agricultural Implements.					218	17
.. Tobacco Experiment.						
Superintendent's Salary October & November, 1911	625	00				
Less Previously, advanced	32	70				
	592	30				
Superintendent's Travelling Expenses	56	11	648	41		
Less Sundry Recoveries	134	25				
Proceeds of sale of Tobacco	465	69	599	94	48	47
,, Cash in Hand.						
At the Bank of Madras			38517	04		
Stock of Stamps			58	50	38575	54
		Rs....			75020	98

of the Society, and that to the best of our belief it is Correct.

FORD, RHODES, CHURCH & Co.

Chartered Accountants.

hopeful means of getting it taken up would appear to be by introducing it into a rotation in suitable areas in connection with the movement for the improvement of chena cultivation. In any case it would be necessary to provide buying agencies at various centres in order to be able to pay cash on delivery of produce.

There are signs in many places that the persistent efforts of the Agricultural Instructors have made an impression on the paddy cultivator, and that he is recognising the advantages of better tillage, the use of green manures, and the transplanting system. The extension of the industry must be looked for in the direction of the tank country where large areas are awaiting settlers.

Tobacco cultivation is making decided strides in Dumbara where a local firm is in a fair way towards establishing a trade with Europe. In this district, thanks to the efforts of planting pioneers of the 'eighties, a suitable type of introduced (probably Cuban) leaf has been fixed and the difficulties attending the necessary preliminary trials for deciding upon a suitable leaf for the European market has in a great measure been overcome. At any rate a tolerably good leaf of fine texture is what is commonly grown by the people, and this after properly handling and curing has proved to be of a quality that is likely to be found useful in European factories.

In Jaffna, on the other hand, the problem of finding a better type of leaf for cultivation in the north has yet to be solved. The Jaffna cultivator may, however, rest assured that the necessity for organising the Tobacco industry and placing it on a surer basis, has not been lost sight of. The question is too important a one for the Northern farmer to be passed over, and a scheme for relieving the present tension in the tobacco trade is likely to be put forward in the near future.

EXPERIMENTAL AND DEMONSTRATION GARDENS AND PLOTS.

During the year under review an EXPERIMENTAL GARDEN was started in *Jaffna* under the supervision of the Agricultural Instructor, Mr. Chelliah. The trial of fodder grasses is receiving special attention here.

The Experimental garden which has been in existence for many years at *Vavuniya* has also been placed under his care. Up to date this garden has been the means of introducing a good type of orange which does particularly well in the district.

Another newly-started garden is that at *Anamaduwa* in the Puttalam District, where very dry conditions obtain.

The *Bandaragama* and *Balangoda* Gardens continue to do good work.

With a view to improving the methods of the CHENA CULTIVATOR, what are known as rotation gardens were established some years ago at *Balalla* and *Mediwaka* ; last year one was started at *Hettipola*. In order to provide for a grain crop every year the area available for cultivation was divided into four sections, each of which was laid under a different crop after the following manner :

1st year cotton, legume, grain, rootcrop.
2nd ,, legume, grain, rootcrop, cotton.
3rd ,, grain, rootcrop, cotton, legume.
4th ,, rootcrop, cotton, legume, grain.

The legume may be green-gram, black-gram, horse-gram or any variety of beans: the grain kurakkan or other kind of millet: and the rootcrop manioc, sweet-potatoes, &c. Cotton was brought in as an experimental crop, but might give place to another, or be left out, and the rotation curtailed.

The Instructors have also been supervising Demonstration plots which have proved so effective in the U. S. A. Here the cultivators are the demonstrators and work under the guidance of the Instructors on a part of their own fields or gardens. In this way the benefits of new methods (e.g., transplanting in paddy cultivation, alternating a cereal with a leguminous crop) are shown in juxta-position with existing methods but without any special machinery, the introduction of which would tend to depreciate the value of the demonstrations.

CHENA CULTIVATION

The discouragement of this method of cultivation, which is generally regarded as wasteful, has evoked a great deal of discussion, and the ventilation of the subject is opportune at the present time when the Agricultural Department is considering the *pros* and *cons* of the case.

While the wholesale suppression of Chena cultivation would mean a serious calamity to the cultivators in the dry zone, its encouragement on existing lines would be tantamount to approving of an archaic system of cultivation instead of seeking to direct it along rational lines of development.

The chief objection to chena ing is its fugitive character, which places it outside the pale of economic agriculture. To begin with we must give the cultivator a continued and more or less permanent interest (at present entirely wanting) in the land, so as to encourage him to care for it better. He must recognise that the fertility of his soil is his chief asset, and that it would be fatal to his interests to allow it to become exhausted. To maintain fertility he must draw upon the undeveloped resources of the soil by tillage, rotation, and other means, and add to it by manuring.

It is only by limiting his operations within reasonable bounds that the cultivator can be brought to a sense of his responsibility to himself as well as to his fellow-men and to the state, and be given an opportunity of changing his character from that of an improvident squatter to a true agriculturist.

If it were found practicable to settle a suitable area of land on each family according to its deserts, then the cornerstone in the reconstruction of a prosperous peasantry will have been laid, and by imposing certain reasonable conditions regarding cultivation, and assisting the cultivator with advice and instruction on the spot, the work of reform should make good progress.

In this connection the value of rotation gardens and demonstration plots should be recognised and their number increased so as to make the Chena cultivator see the wisdom of improving his methods instead of blindly following an effete system.

CO-OPERATIVE CREDIT SOCIETIES.

A fresh impetus was given to this movement by the appointment last March of the Director of Agriculture as Registrar under the Ordinance. Mr. N. Wickremaratne, one of the Senior Agricultural Instructors, has been appointed Secretary and has settled down to his new duties with his wonted

enthusiasm. On May 30th, a meeting of Agricultural Instructors was held at Peradeniya when the Director of Agriculture addressed the officers with a view to enlisting their services in popularising a measure which is destined to be one of the main props in lifting the cultivator from the depression into which he has sunk. Since then considerable progress has been made and many meetings have been held in connection with the movement. Up to date the following societies have been registered :—The *Dumbara* Society, The *Wellaboda Pattu* Society with a share capital of Rs. 4,000/-, the *Weligam Korale* Society with Rs. 2,000/-, The *Hinidum Pattu* Society with Rs. 1,000/-, the *Galboda and Kinigoda Korales* Society with Rs. 10,000/-, the *Akmimana and Galle Four Gravels* Society with Rs. 1,000/-, the *Gangaboda Pattu* Society with Rs. 1,000/-, the *Puttalam* Society with Rs. 1,000/-, and the *Harispattu* Society with Rs 1,000/-.

An invitation to the Registrar to preside at a conference proposed to be held in the Eastern Province, is likely to lead to practical results. The conditions are all the more favourable from the fact that the present Government Agent of the Province was among the first to draft a scheme in connection with the Co-operative Credit movement when he was in charge of the Uva Province. In this connection it should be mentioned that Dr. Willis, while officiating as Organising Vice-President, never missed an opportunity of preaching Co-operative Credit.

In addition to the Secretary's pamphlet entitled "A Word about Co-operative Credit Societies" some interesting contributions to the literature on the subject have been made from other sources, notably by Messrs. E. R. Tambimuttu and T. P. Massillamany.

THE TROPICAL COLLEGE OF AGRICULTURE.

The idea of a Tropical College of Agriculture has been generally approved of, while the proposal that Ceylon should be the *venue* of this great training institution for the tropical world (or at least the tropical East), has found favour in high quarters. The support of past Governors and of friends of the Colony resident in England has helped to push home the claims of Ceylon, while at to-day's meeting the Director of Agriculture will submit his suggestions for the organising of the College.

The appointment by the Society of a powerful London Committee and of so able a deputy as Sir Edward Rosling, has brought about important developments in the Mother Country where the matter has been taken up with an enthusiasm that is full of promise.

CONCLUSION.

The publication of quarterly progress reports embodying full details of the different phases of practical work carried on by the Society makes it unnecessary to recapitulate the facts therein recorded.

With the Director of Agriculture as Organising Vice-President, the Society enters upon a new and, it may be expected, more useful stage of its existence. Indeed the advent of the Director has been the means of arresting general attention to the importance of the work with which his Department is concerned, and of elucidating the fact that Agriculture is the nursing mother of the State.

C. DRIEBERG,
Secretary.

Peradeniya,
12th August, 1913.

SOME SOUTH AFRICAN FIGURES.

The following extracts dealing with the Exports and Imports, etc., of South Africa are culled from the Report of the proceedings at the Ninety-ninth Meeting of the Shareholders of the Standard Bank of South Africa:—

EXPORTS AND IMPORTS.

The Union Government revenue has materially exceeded the estimates, and the trade returns show increases in exports and imports which aggregate well over £106,000,000 for 1912, as against £98,000,000 in 1911. Of the expansion in the exports of over £6,000,000 during the twelve months, gold and diamonds are responsible for over £4,000,000.

SOUTH AFRICAN PRODUCE.

Exports of other South African produce have improved some £2,000,000 of which £900,000 is due to wool, £480,000 to hides and skins, and £350,000 to ostrich feathers. Still, we have to face the fact that, of the total exports of £65,000,000, gold and diamonds account for £50,000,000.

EXPORTS IN 1908 AND 1912.

We must all look forward to the day when the value of produce other than minerals shall represent a large proportion of the total exports. In the meantime some encouragement may be derived from the following comparison of the values of exports in 1908 and 1912 respectively :—

		1908.		1912.
Wool	...	£2,768,000	...	£4,781,000
Feathers	...	1,738,000	...	2,610,000
Mohair	...	710,000	...	967,000
Hides and Skins	...	771,000	...	1,685,000
Coal	...	766,000	...	1,173,000
Tin	...	114,000	...	246,000
Maize	...	207,000	...	443,000
Bark	...	135,000	...	283,000
Whale oil	...	9,000	...	151,000
	Total	£7,218,000	...	£12,339,000

That is an increase of 71 per cent.

HIGHER VALUES.

As regards some of these articles, a part at least of the expansion is, no doubt, due to higher values, but a greater proportion of the increases shown represents larger shipments—i.e. wool, feathers, mohair, hides and skins, maize, bark and whale oil. In this connection it may be interesting to mention that the figures dealing with live stock and agriculture within the Union of South Africa (apart from Rhodesia) at the date of the last Census, May 7, 1911, have just been published, and show that since 1904, the date of

the previous Census.—

Cattle	have increased	in number	by 65	per cent.
Horses	do	do	60	do
Donkeys	do	do	137	do
Ostriches	do	do	106	do
Sheep	do	do	87	do
Goats	do	do	20	do
Pigs	do	do	59	do
Poultry	do	do	66	do

That is an average of 75 per cent. all through.

AREA UNDER CULTIVATION.

I resist the temptation to lead you into a wilderness of figures, but I feel obliged to inform you that the total area under cultivation in the Union is now more than three million morgen or, say, six million acres; that there are :—

17,000	morgen or, say,	36,000	acres under	vines,
37,000	do	77,000	do	orchards
and 10,000	do	22,000	do	vegetables;

that there are :—

464,000 morgen or, say, 975,000 acres under irrigation, and that
34,000,000 morgen or, say, 72,000,000 acres have been fenced in.

These figures afford encouragement to those who believe in the future adequate development of the pastoral and agricultural resources of South Africa.

Until the Doctor Comes.

Be prepared for accidents.
Avoid the serious consequences which often follow neglect of wounds, etc.

TRADE MARK 'TABLOID' BRAND FIRST-AID

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AUSTRALIAN MANGROVE BARK.

The writers, F. A. Coombs and F. Alcock discuss the probabilities of a successful starting of a mangrove extract industry in Australia. They mention the difficulties in finding the most suitable places for a centre of such industry, being themselves in favour of Cairn and Cooktown on the Queensland coast. Three different kinds of mangrove bark are distinguished, viz: *Rhizophora mucronata* Lam., *Bruguiera gymnorrhiza* Lam., and *Ceriops candolleana* Arn. *Rhizophora* is the most important of them representing fully 75 per cent. of the trees which it would pay to strip; it is characterized by its arched roots above the water growing on the water side of the mud and sand banks, while *Bruguiera* appears to grow best where the banks begin to shelve off to higher and firmer ground. The two are usually known under the name of black mangrove. *Ceriops* is the least common of the three and does not yield anything like the same amount of bark as *Rhizophora* or *Bruguiera*.

The amount of ross influences considerably the analytical figures obtained, as ross only shows 6 per cent. tannin (average) while the bark contains about 30 per cent. The various mangrove barks have different thicknesses of ross and *Rhizophora* shews an average percentage of ross of 22·6, *Bruguiera* 37·5 and *Ceriops* 28·8. The analyses of mangrove bark given later are carried out on the bark with the ross on. Barks freed from ross would of course shew distinctly higher figures.

As regards drying of mangrove bark, the writers recommend to collect green bark from the strippers at regular intervals and carry it by boat to a convenient drying centre. 100 lb. green wet bark yield 66 lb. (average) of air dry bark of 10·3 per cent. moisture.

It was found that the largest (and oldest) trees carry the stoutest bark with the highest tannin value (see table).

	Rhizophora.					Bruguiera.			Ceriops.	
Diameter ... ins.	4	8	10	12	16	5	9	15	4	10
Tannin ... %	28·2	30·3	3·40	38·6	40·4	25·8	29·8	36·4	25·8	32·4

The tannin figures (official method) of different barks, calculated on 12·5 per cent. moisture, are given in the next table, where a few figures of

Paessler on East African mangrove barks are added for comparison.

	Rhizophora. (21 samples)		*Bruguiera* (8 samples)		*Ceriops* (6 samples)		Paessler's tannin fig.
	% tan	% non-tans.	% tan	% non-tans.	% tan	% non-tans.	
Average ...	23·1	10·6	29·1	9·0	30.5	11·4	36·5
Maximum ...	40·4	12·7	36·4	11·8	32·4	15·0	35·8
Minimum ...	28·2	7·7	23·6	7·0	28·5	7·9	25·8

Monthly Bulletin.

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THE WORLD'S CATTLE.

The following table showing the cattle of the World is reproduced from "Die Ernahrung der Pflanze" in the *Queensland Agricultural Journal*:—

1.	British India ...	121,611,599	17.	Sweden ...	2,747,526
2.	United States ...	57,959,000	18.	Roumania ...	2,588,526
3.	Russia ...	37,343,075	19.	Denmark ...	2,253,982
4.	Argentine ...	29,116,625	20.	Bulgaria ...	2,172,405
5.	Germany ...	20,630,544	21.	Holland ...	2,026,943
6.	France ...	14,532,030	22.	New Zealand ...	2,020,171
7.	Austria ...	9,159,901	23.	Cape of Good Hope	1,953,126
8.	Uruguay ...	8,192,602	24.	Belgium ...	1,856,833
9.	Hungary ...	7,318,281	25.	Victoria ...	1,547,569
10.	Great Britain ...	7,114,264	26.	Finland ...	1,522,028
11.	Canada ...	7,086,600	27.	Turkey in Europe	1,471,801
12.	Italy ...	6,198,861	28.	Switzerland ...	1,443,371
13.	Mexico ...	5,142,457	29.	Japan ...	1,384,183
14.	Queensland ...	5,073,201	30.	Bosnia and Hertzegovina	1,309,922
15.	Ireland ...	4,711,720	31.	Chili ...	1,220,203
16.	New South Wales	3,140,307	32.	Algeria ...	1,127,577

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MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Latest Monthly Prices Current.

	QUALITY.	Quotations.
ALOES, Socotrine cwt.	Fair to fine	45/6 a 55/
Zanzibar & Hepatic ,,	Common to good	40/ a 65/
ARROWROOT (Natal) lb.	Fair to fine	8d a 9d
BEES' WAX cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair	£7 7/6 a £7 10/
East Indian, bleached ,,	Fair to good	£8 10/a £8 12/6
,, unbleached ,,	Dark to good genuine	£6 5/ a £6 15/
Madagascar ,,	Dark to good palish	£7 10/ a £7 15/
CAMPHOR, Japan ,,	Refined	1/ 4½ a 1/6
China ,,	Fair average quality	155/
CARDAMOMS, Tuticorin	Good to fine bold	4/9 a 5/3
per lb.	Middling lean	4/1 a 4/6
Malabar, Tellicherry	Good to fine bold	4/8 a 5/2
Calicut	Brownish	4/1 a 4/6
Mangalore ,,	Med Brown to good bold	4 4 a 5/10
Ceylon Mysore ,,	Small fair to fine plump	3/3 a 5/3
Malabar ,,	Fair to good	3/3 a 3/4
Seeds, E. I & Ceylon ,,	Fair to good	3/10 a 4/
Ceylon "Long Wild" ,,	Shelly to good	1/2 a 3/2
CASTOR OIL, Calcutta ,,	Good 2nds	3⅜ d
CHILLIES, Zanzibar cwt.	Dull to fine bright	37/6 a 45/
Japan ,,	Fair bright small	28/ a 32/6
CINCHONA BARK.—lb.	Crown, Renewed	3⅜ d a 7 d
Ceylon	Org. Stem	2d a 6d
	Red Org Stem	1¾ d a 4¼d
	Renewed	3d a 5¼d
	Root	1⅞d a 4d
CINNAMON, Ceylon 1sts.	Good to fine quill	1/3 a 1/7
per lb. 2nds.	,, ,,	1/3 a 1/6
3rds.	,, ,,	1/1 a 1/5
4ths.	,, ,,	1/ a 1/3
Chips, &c.	Fair to fine bold	2d a 4d
CLOVES, Penang lb.	Dull to fine bright pkd.	11d a 1/1
Amboyna ...	Dull to fine	10d a 10½d
Zanzibar ...	Fair and fine bright	7½d a 8¾d
Madagascar ...	Fair	7¼d
Stems ...	Fair	2½d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	Nominal
Native	Good ordinary	Nominal
Liberian ,,	Fair to bo'd	77/a 84/
COCOA, Ceylon Plant, ,,	Special Marks	86/ a 95/
	Red to good	81/ a 85/
Native Estate ,,	Ordinary to red	42/ a 78/6
Java and Celebes ,,	Small to good red	30s a 96s
COLOMBO ROOT ,,	Middling to good	12/ a 19/6
CROTON SEEDS, sift. cwt.	Dull to fair	45/ a 50/
CUBEBS ,, ,,	Ord. stalky to good	140/ a 170
GINGER, Bengal, rough ,,	Fair	30/ nom.
Calicut, Cut A ,,	Medium to fine bold	60/ a 75
B & C ,,	Small and medium	36/ a 60/
Cochin Rough ,,	Common to fine bold	28/ a 32/
	Small and D's	27/6
Japan ,,	Unsplit	23/
GUM AMMONIACUM ,,	Ord. Blocky to fair clean	40s a 72s 6d
ANIMI, Zanzibar	Pale and amber, ster. srts	£12 10/ a £14 5/
	,, ,, little red	£11 a £12
	Bean and Pea size ditto	70/ a £9
	Fair to good red sorts	£7 a £10
	Med and bold glassy sorts	£5 a £7 10/
Madagascar ,,	Fair to good palish	£4 a £8
	,, ,, red	£4 a £7
ARABIC E. I. & Aden ,,	Ordinary to good pale	28/ a 32/ nom
Turkey sorts ,,		32/6 a 55/
Ghatti ,,	Sorts to fine pale	18/6 a 32/6nom
Kurrachee ,,	Reddish to good pale	25 a 30s nom
Madras ,,	Dark to fine pale	22/6 a 29/6nom
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£7 a £8
	com. stony to good block	40s a £5 12/6
KINO	Fair to fine bright	6d a 1/5
MYRRH, Aden sorts cwt.	Middling to good	50/ a 62/6
Somali ,,	,, ,,	42s 6d a 45s
OLIBANUM, drop ,,	Good to fine white	45s a 50s
	Middling to fair	35s a 40s
pickings ,,	Low to good pale	15/ a 27/6
siftings ,,	Slightly foul to fine	20s a 22s 6d
INDIA RUBBER lb.	Fine Para bis. & sheets	2/9½
	,, Ceara ,, ,,	2/7½
Ceylon, Straits,	Crepe ordinary to fine	2/9½ a 2/9¾
Malay St etc.	Fine Block	2/9
	Scrap fair to fine	2/1
Assam	Plantation	2/3
	Fair 11 to ord. red No. 1.	1/8 a 1/9
Rangoon	,, ,, ,,	1/7 a 1/9

	QUALITY.	QUOTATIONS.
INDIARUBBER		
Borneo	Common to good	1/4 a 1/7
Java	Good to fine red	1/6 a 1/8
Penang	Low white to prime red	10 d a 1/8
Mozambique	Fair to fine red ball	2/2 a 2/7
	Sausage, fair to good	2/2 a 2/6
Nyassaland	Fair to fine ball	2/ a 2/ 4
Madagascar	Fr to fine pinky & white	1/7 a 1/10
	Majunga & blk coated	1/2 a 1/5
	Niggers, low to good	6d a 1/6
New Guinea	Ordinary to fine ball	1/4 a 1/6
INDIGO, E.I. Bengal	Shipping mid to gd violet	3s a 3s 6d
	Consuming mid. to gd.	2s 3d a 2s 10d
	Ordinary to middling	2s a 2s 2d
	Mid. to good Kurpah	1s 10d a 2s 5d
	Low to ordinary	1s 6d a 1s 9d
	Mid. to fine Madras	None here
MACE, Bombay & Penang	Pale reddish to fine	2/6 a 2/8
per lb	Ordinary to fair	2/2 a 2/4
Java	,, ,, good pale	2/4 a 2/8
Bombay	Wild	10d a 1.
NUTMEGS,— lb.		
Singapore & Penang ,,	64's 57 s	9½d a 10½d
	80's	7d
	110's	6½d
	160's to 115's	6d
NUTS, ARECA cwt.	Ordinary to fair fresh	17/6 a 20/
NUX VOMICA, Cochin	Ordinary to good	9/6 a 12/
per cwt. Bengal	,, ,,	8/9
Madras	,, ,,	8/6 a 9/6
OIL OF ANISEED ,,	Fair merchantable	7/
CASSIA ,,	According to analysis	3/2 a 3/7
LEMONGRASS ,,	Good flavour & colour	3d
NUTMEG ,,	Dingy to white	1½d a 1¾d
CINNAMON ,,	Ordinary to fair sweet	2¼d a 1s 5d
CITRONELLA ,,	Bright & good flavour	1/8½
ORCHELLA WEED—cwt		,,
Ceylon ,,	Fair	10/ Nom.
Madagascar ,,	Fair	10/ ,,
Zanzibar ,,	Fair	10/ ,,
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair	5⅛d a 5½d
Ceylon ,, ,,	Fair to fine bold heavy	5½d a 5¾d
Singapore ...	Fair	5⅜d
Acheen & W. C. Penang	Dull to fine	5d a 5½d
(White) Singapore ,,	Fair to fine	8½d a 9d
Siam ,,	Fair	8½d
Penang ,,	Fair	8d
Muntok ,,	Fair	9⅛d
RHUBARB, Shenzi ...	Ordinary to good	3/6 a 4/6
Canton ...	Ordinary to good	3/ a 4/
High Dried ...	Fair to fine flat	1/ a 1/2
	Dark to fair round	10d a 1/
SAGO, PEARL, large	Fair to fine	18/
medium ...	,, ,,	17/
small ...	,, ,,	13/6 a 15/6
Flour ...	Good pinky to white	11/ a 12/
SEEDLAC cwt.	Ordinary to gd. soluble	60/ a 70/
SENNA, Tinnevelly lb.	Good to fine bold green	4½d a 8½d
	Fair greenish	2⅜ a 4d
	Common specky & small	1d a 2¼d
SHELLS, M. o' PEARL—		
Egyptian cwt.	Small to bold	82/6 a £ 9 10/
Bombay ,,	,, ,,	70/ a £9 2/6
Mergui ,,	Chicken to bold	10 17/6 a 14 2/6
Manilla ,,	Fair to good	£95/ a £14 10/
Banda ,,	Sorts	70/ a 90/
Green Snail ,,	Small to large	55/ a 92/6
Japan Ear ,,	Trimmed selected small to bold	72/6 a £9
TAMARINDS, Calcutta...	Mid to fine bl'k not stony	10s a 12s
per cwt. Madras	Inferior to good	6/ a 10/
TORTOISESHELL—		
Zanzibar, & Bombay lb. all	Small to bold	13/ a 34/
	Pickings	13/ a 21/
TURMERIC, Bengal cwt.	Fair	16/ Nom
Madras ,,	Finger fair to fine bold	16/6 a 18/
Do. ,,	Bulbs ,, ,, bright	14/ a 15/
Cochin ,,	Finger fair	16/
	Bulbs ,,	14/
VANILLOES— lb.		
Mauritius ... } 1sts.	Gd. crystallized 3½a 8½a in.	11/6 a 16/
Madagascar ... } 2nds.	Foxy & reddish 3½a ,,	11/ a 12/6
Seychelles ... } 3rds.	Lean and inferior ,,	11/ a 11/6
VERMILLION ...	Fine, pure bright	2/9
WAX, Japan, squares	Good white hard	44/